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Using mobile phone technology outside class time to develop first year university students' independent study skills

Pranit Shailesh Anand
University of Wollongong

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Faculty of Social Sciences

School of Education

**Using mobile phone technology outside class time to develop first year
university students' independent study skills**

Pranit Shailesh Anand

**This thesis is presented as part of the requirement for the
award of the Degree of Doctor of Philosophy
of the
University of Wollongong**

March 2015

DECLARATION

I, Pranit Shailesh Anand, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy in the Faculty of Social Sciences, School of Education, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualification at another institution.

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To my wife, Yu Lian, thank you for everything you did for me. Thank you for your encouragement and motivation. Your support ensured I remained sane! You have shared all the joys and pains with me.

This thesis is dedicated to my mum who passed away early in my candidature. You were an inspiration and your memory continued to inspire me throughout the research. I am sure you would have been proud of me.

CANDIDATE’S STATEMENT ABOUT THE STYLE OF THESIS

This thesis is submitted as a thesis by compilation. It includes five ‘in-preparation’ journal manuscripts for future submission and three conventional thesis chapters. A synopsis explaining the purpose and content of each chapter is provided in the introduction chapter. The target journals for publication of the manuscripts are identified and these selected peer-reviewed journals include published papers that promote knowledge sharing in the areas of learning design, educational technologies and mobile learning, which are aptly suited for the content of this thesis.

The ‘Thesis by Compilation’ format was chosen for this research on the advice on my supervisors for two reasons. Firstly, this approach allowed me to develop an understanding of journal manuscript preparation during the period of my doctorate. This has given me the opportunity to work intensively on multiple papers under the close guidance from my supervisors, both of whom have significant publishing experience. This has been invaluable to my development as a researcher. Secondly, by having these papers in an advanced state of preparation, it will enable me to contribute the rapidly developing literature in educational technology in a timely fashion.

ABSTRACT

Independent study skills are essential for student success in the first year of university. Students often need help to develop independent study skills that will enable them to work effectively individually and collaboratively, particularly outside formal class time. Increases in student numbers and more diverse student population have made it both more important and more challenging for universities to effectively and efficiently support students to develop their independent study skills.

Universities could support students in developing independent study skills by using technology that most students bring with them to university – the mobile phone. The ubiquity of mobile phones has generated debate about how this technology could be leveraged to support student learning. Proponents of ‘mobile learning’ argue that mobile technologies can enhance both formal learning that occurs in dedicated learning spaces and is bound by intended learning outcomes, and informal learning occurring outside dedicated learning spaces without strict objectives or expected outcomes.

Educators and institutions have become particularly interested in applications of mobile learning that bridge the gap between formal and informal learning, extending their reach into spaces and times that have previously been regarded as outside the scope of formal education. Such approaches offer opportunities to flexibly deliver programs that complement formal coursework, such as study skills support. Initial practical applications of this kind have been promising, but further work is needed to create and test the efficacy of programs underpinned by theoretical models of independent learning.

This thesis presents research that addresses this gap through a case study of the design, development, implementation and evaluation of a study skills development program for first year university students delivered using mobile phone technology. Specifically, the program operationalised theoretical concepts from self-regulated learning in the form of learning prompts sent to students by text messages. The purpose of the study was to derive design principles to support the development of independent study skills using mobile phone technology, identify practical

implications for teachers and institutions, and highlight avenues for future research and development.

The case study collected data from 69 first year university students at an Australian university. Participants' self-regulated learning skills were assessed at the beginning of the study using the cognitive learning strategies section of the Motivated Strategies for Learning Questionnaire (MSLQ). Students were then sent text messages, for a period of six weeks, designed to strengthen their skills in the component in which their score was lowest. Their self-regulated learning skills were reassessed after completion of the study skills program. Their experiences of this type of mobile learning were also explored using a questionnaire administered to all participants and face-to-face interviews with a subset of eleven participants.

Most students found the prompts engaging and reported that following the instructions helped them to become more aware of their study skills. The MSLQ results showed that most participants improved in their self-regulated learning skills, which suggests that providing individually relevant learning support via mobile learning can be beneficial. The study also found that text messages can be a suitable medium to engage with the students outside class. There were, however, some important caveats raised from the negative experiences of some participants who perceived mobile learning during their personal time as a disruption.

This study demonstrated the potential effectiveness of mobile learning to develop self-regulated learning skills by prompting students with relevant study instructions at various times outside of class. While the results of this research study are encouraging, the approach should be trialled with students from other discipline areas and backgrounds, and include research methods that rely less on student self-reports, such as controlled ability tests and online traces. Longitudinal studies could also investigate the impact of this type of support on attrition, study success after first year, further study and employment.

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1 INTRODUCTION

This introductory chapter sets the scope of this research study by explaining the background, significance, research questions, methodology, context and limitations of the study, as well as providing definitions of key terms used. The final section describes the structure of the thesis, including a synopsis of each chapter, indicating whether it is a conventional thesis chapter or an ‘in-preparation’ manuscript. For the chapters presented in manuscript form, planned outlets for publication and the relative contributions of each author are stated.

1.1 Background

Students entering the first year of higher education often find themselves in an educational environment very different to the one from which they have come, be that high school, an overseas educational institution, vocational education or a break from formal study (Jones & Edwards, 2009). As university student populations continue to increase, there is greater diversity in the preparedness of first year students. Furthermore, as universities embrace more sophisticated student-centred learning and assessment approaches, like authentic and experiential learning, it is even more important for students to develop and apply effective independent study skills (Dabbagh & Kitsantas, 2004; Field, Duffy, & Huggins, 2014).

Independent study skills include students’ ability to manage their own learning. A number of large scale studies in Australia and overseas have identified various study skills that are characteristic of independent learning and promote greater engagement with the teaching and learning activities (Lawrence, 2002; Skene, Hogan, & Brown, 2006; Taylor, 2008; Zimmerman, 2000). Though there is some variation in what is said to constitute these independent study skills, there is widespread agreement that self-regulated learning skills are an essential component of the independent study skill set that students must develop in their first year at university (Field, et al., 2014).

Self-regulated learning includes motivational inclinations for students to learn and cognitive learning strategies for effective study. Highly developed self-regulated learning skills are linked to better academic performance and lower attrition rates among first year students (Cleary & Platten, 2013). The Motivated Strategies for

Learning Questionnaire (MSLQ) is one of the most popular tools for assessing many of the motivational and learning strategies of college and university students associated with a theoretical model of self-regulated learning (Pintrich, 2004). The questionnaire consists of self-report items across five key areas, including: value, expectancy and affective components of motivation; and cognitive, metacognitive and resource management learning strategies. Students generally have different levels of competence across different components. For example, a student may be extremely competent in applying rehearsal learning strategies, but may struggle with organisation, therefore affecting the overall effectiveness of his/her self-regulated learning.

Strategies for developing independent learning skills may first assess a student's current learning strategies using the MSLQ and then target specific areas that need improvement (Garcia, Pintrich, McKeachie, & Smith, 1993). Research has shown that with effective training it is possible to develop these self-regulatory study behaviours through "direct teaching, modelling, guided and independent practice, feedback, self-observation and social support" (Torrano & Torres, 2004, p. 17).

A key challenge for initiatives seeking to develop self-regulatory study behaviours is how best to integrate them into the busy lives of students. Most universities offer flexible, technology-supported approaches that reach students wherever they are. These include providing online programs to develop study skills during the first semester of university and extend those study skills in later semesters, for example the StartSmart and StaySmart programs at the University of Wollongong (Cooper, 2011). Recent advances in mobile technology and high levels of mobile device ownership amongst students offer opportunities to extend such programs through mobile learning.

Most applications of mobile technologies for learning to date have focussed on providing access to learning materials on web-enabled mobile devices (Andrews, Smyth, & Caladine, 2010; Laru & Jarvela, 2008; Mellow, 2005), or the use of 'texting' to make announcements to students (Cheung, 2004; Jones, Edwards, & Reid, 2009; Leech, 2006). These are useful strategies, but the potential of these devices to

support learning is yet to be fully explored. For example, the ubiquitous nature of these devices can promote learning ‘anywhere, anytime’, thus blurring the boundaries between a student’s formal learning in class and their informal learning outside class. More research is needed to understand how mobile technologies could be used to engage students in outside of class time to promote learning. Further, the personal nature of mobiles phones lends itself to learning programs that are personalised according to student’s individual learning needs (Johnson, Adams Becker, Estrada, & Freeman, 2014; Laurillard, 2002).

To date, there have been a small number of studies applying mobile learning to the challenge of developing students’ independent study skills. These include use of a mobile game for independent second language learning (Kondo et al., 2012) and generic persuasive text messaging to prompt students to study at appropriate times (Goh, Seet, & Chen, 2012). The findings of these studies suggest that mobile learning can facilitate the development of independent study skills, but neither of these studies used a reliable instrument based on a theoretical model to identify and target the development of independent study skills for each student. The study reported in this thesis addresses this gap by investigating how mobile phone technology can be used to support students to develop their self-regulated learning skills in their outside class time.

1.2 Significance

The problem this study addresses is significant because many students arrive at university without the level of independent study skills they need to be successful. Self-regulated learning, widely believed to be critical to independent study, has been shown to contribute to overall performance of university students, as well as to lower attrition rates (Bamforth, 2010; Cleary & Platten, 2013; Taylor, 2008; Wilson, 2009). Improvements in self-regulated learning are therefore likely to help more students adapt to the university context, achieve early success in their studies, remain enrolled in their programs, and develop basic study skills they can build on throughout their degree. Effective self-regulated learning skills are also likely to assist those who wish to pursue further study, and have application in work contexts after graduation (Gurtner, Cattaneo, Motta, & Mauroux, 2011).

This study is significant because it extends existing research by evaluating a novel strategy that uses text messages to identify an aspect of self-regulated learning that a student can improve and then develop that aspect through a series of targeted text messages delivered outside class time. The approach is underpinned by previous research and theory in self-regulated learning. This is novel because many previous applications of mobile learning have been practically focused and not underpinned by theories of learning. Furthermore, the study investigates the experiences of students as they engage in mobile learning that spans inside and outside class. This is another important aspect of mobile learning which we currently know little about.

1.3 Research questions

This research was guided by two research questions:

1. How can first year university students be supported to develop their independent study skills using mobile phone technology?
2. How does the use of mobile phone technology influence first year university students' engagement in learning outside class?

1.4 Methodology

The research questions were addressed by designing, implementing and evaluating a study skills development program to improve students' independent study skills by delivering a number of learning prompts via text message to first year students outside their class time. The pedagogical design was theoretically informed by the self-regulation learning literature. The technical and logistical design was informed by a preliminary study that explored how mobile phone technology could be appropriately implemented in a subject/course (hereafter referred to as subject).

The study was conducted with a cohort of the first year Bachelor of Education students enrolled in an introductory educational technology subject at the University of Wollongong. Informed by the results of a preliminary study and the literature review, a study skills development program was designed and implemented. This study skills development program supported students to develop their self-regulated learning skills using students' mobile phones over a six-week period.

The study skills development program developed for this study involved firstly assessing student's cognitive learning strategies using the relevant sub-scales of the MSLQ. A series of learning prompts, with appropriate study strategy instructions, were then sent to students by text message over a six week period to help them improve their weakest cognitive learning strategy. The impact of the study skills development program on the participants' cognitive learning strategies was measured by comparing pre- and post-scores on the cognitive learning strategies sub-scale of the MSLQ. Further responses to a questionnaire and interviews with a sub-set of participants provided insights into the student experiences of this application of mobile learning.

A case study methodology was chosen for this study. A case study is suitable for a detailed examination of a complex phenomenon that is limited in scope to a single setting or event and enables researchers to study a bounded system in depth (Creswell, 1998). For this study, the case consisted of the development of a specific study skills development program and investigation of its impact on a particular group of first year students. Studying the development of study skills is a complex process (Dabbagh & Kitsantas, 2004; Nota, Soresi, & Zimmerman, 2004). It involves understanding effective learning behaviours and how these behaviours influence improvements in learning. By using a case study for this research, data from various sources could be used to explore the impact of the program on participants' study skills, as well as their experiences of receiving learning prompts via text message outside class.

1.4.1 The preliminary study

Prior to the main study, a preliminary study was conducted to test the reliability and appropriateness of mobile text messaging technologies for the approach intended. For example, sending a one-off text message to a single individual is a relatively easy and convenient process, but sending large numbers of text messages to multiple individuals and varying those messages depending on the recipient requires careful planning and use of more efficient technologies to enable the sending of bulk text messages.

The goals of the preliminary study were to:

1. implement and test the technology required to send and receive bulk text messages.
2. develop a preliminary understanding of students' reactions' to receiving study-related text messages during out-of-class times.
3. develop an initial understanding of the impact of using targeted, persuasive text messages on students' learning behaviours.

For logistical reasons the preliminary study was conducted in a different subject to the main study, and focused on peer learning strategies rather than self-regulated learning at the request of the subject coordinator. This optional program, developed in collaboration with the subject coordinator, aimed to support student pairs to collaboratively revise a topic in preparation for the final exam. All students enrolled in the subject were invited to participate and 224 volunteered to be part of the study. Participants were allocated to pairs and then sent a series of text messages outside class time over a four-week period, which provided study advice.

The preliminary study found that the participants were receptive to the study-related text messages outside class time and, although most did not adopt the collaborative approach intended, they reported finding the text to be useful prompts to encourage them to engage in individual study. These findings were used to refine the design of the main study.

The methodology and findings of the preliminary study are described in more detail in Chapter Four.

1.5 Ethics

The protocols approved by the University of Wollongong Human Research Ethics Committee (see Appendix A) first covered the preliminary study and were then modified for the main study. In each study, all students enrolled in the subjects were invited to participate in the research by being given a participant information sheet and completing a consent form (see Appendix B). Students were assured that they were not obliged to participate in the research and were able to discontinue their participation at any time during the study and have their data destroyed. To ensure

that no student was disadvantaged, all students were given the option of receiving the text messages without having to participate in the data collection. All participants were assigned pseudonyms before being reported in this thesis to protect their privacy.

1.6 Limitations

The main limitation of this study is it a case study and as such the findings cannot be generalisable beyond the context of this research. The research was conducted with students enrolled in an introductory educational technology subject in the first year Bachelor of Education degree program at the University of Wollongong. This introductory educational technology subject introduced students to various educational technology tools that they could use in their own teaching after graduating. Due to this context, the participants in this study were aware about the significance of technology use to enhance learning and were interested in the implementations of this study, as a learning experience for their own practice at a later time. Because of this they may have been more receptive to the use of text messaging and so the findings of this study may not be generalisable to students in other programs of university. The results might be different if the students are not as inherently interested in understanding mobile learning implementations as a learning exercise for their own future practices.

1.7 Definitions of terms

This section provides a definition of key terms used in this thesis.

Classification refers to the strength of boundaries that exist between different contexts (Bernstein, 1971; Chen, Bennett, & Maton, 2007). For example, there are boundaries between different courses/subjects, between inside class activities and outside class activities, and between students' social life and academic study life. *Classification* was used in this study to conceptualise the existence of boundaries between inside class and outside class learning.

Formal learning is learning activities that occur within structured learning environments, like classrooms and lecture theatres. While this definition is used extensively in the literature (Abdullah, Hussin, Asra., & Zakaria, 2013; Rapetti,

Picco, & Vannini, 2011), formal learning is also used as a broader term meaning any learning that is guided by identified learning outcomes of a course, unit or subject regardless of where the learning takes place. Based on this, then a more appropriate way to define formal learning is by using the domains of *structure* and *intent* (Sefton-Green, 2004). Structure refers to the physical spaces where the learning takes place, formal structures are dedicated physical learning spaces like classrooms, lecture theatres, laboratories and the like. Intent refers to the objectives of the course used to promote learning, formal intent is when students undertake learning activities, as part of an enrolled subject. Formal learning is used in this study to refer to formal on both intent and structure and is referred to in this thesis as ‘inside class’.

Independent study skills is a general set of skills that refers to the ability of students to manage their own learning. This requires students to manage their own time, workload and deadlines for effective participation in teaching and learning activities. An important aspect of independent study skills is learning how to learn, where students identify and apply appropriate learning strategies that are deemed effective in enabling them to acquire required skills and knowledge. Independent study skills can be developed by helping students to develop their self-regulated learning skills (Field, et al., 2014). By applying self-regulated learning skills, students become more independent learners.

Informal learning signifies learning activities that take place outside formal learning spaces, for example individual study at home, studying with peers in a café or collaborative work in a library. While this definition is used extensively in the literature (Andrews, et al., 2010; Comas-Quinn, Mardomingo, & Valentine, 2009), the term is also used in the literature for any learning that is unintentional, as well as learning that is not bound by identified objectives of a subject or course (Timmis, 2012). Therefore an effective definition of informal learning includes the domains of *structure* and *intent* (Sefton-Green, 2004). Informal learning according to structure is learning that takes places outside dedicated physical learning places such as private homes, public transport, cafes and other social, professional or public spaces. Informal learning according to intent is learning that is serendipitous and often unplanned. Informal learning is used in this study to refer to informal learning on both

intent and structure. The literature uses informal learning to also refer to all learning that occurs ‘outside class’ and the same terminology is used in this thesis.

Mobile learning has been defined by a number of authors as the practice of learning when the learner is mobile or not at his/her normal location (Vavoula & McAndrew, 2005). It can be argued that mobile learning can occur with the use of conventional learning tools such as pen and paper, text books, printed lecture notes and the like. Yet there are other authors who suggest that mobile learning also includes learning activities that utilise mobile devices (McManus, 2002). Mobile learning is referred in his study to include learning when the learner is mobile while using mobile wireless devices such as mobile phones, smart phones, personal digital assistants, laptops and other such devices to support their learning activities.

Outside class refers to the time that students spend outside of their scheduled classes (Sefton-Green, 2004). This includes the time students spend on personal study, socialising, work, sports and the like. Teachers are generally very capable of managing students learning when they are inside the class, but have no control about students learning as soon as they leave their class. Strategies to engage with students when they are outside class can be seen as bridging the gap between inside class and outside class learning.

Self-regulated learning skills refer to the ability of students to manage their own learning. It is considered an important aspect for independent learning in universities and similar higher education institutions. Self-regulated learning skills are made up of a range of learning skills and strategies for learning, which can be categorised as students’ motivational inclinations and cognitive learning strategies. The motivational inclinations of self-regulated learning involve students’ beliefs and goals about studying. The cognitive learning strategies of self-regulated learning include the learning strategies that students use to study. This study uses the cognitive learning strategies aspect of self-regulated learning to identify and develop students’ individual learning skills (Pintrich, Smith, Garcia, & McKeachie, 1991). The cognitive learning strategies includes six components which are rehearsal, elaboration, organisation, meta-cognition, time and space management and self-effort

(Zimmerman, 2000). Self-regulated learning skill is used in this research to refer to the cognitive learning strategies of self-regulated learning.

1.8 Thesis structure

This research is reported in the ‘thesis by compilation’ format and is presented as a combination of conventional thesis chapters and chapters that are written in the form of ‘in-preparation’ journal article manuscripts which are yet-to-be published. The purpose of presenting a thesis in this format is to afford me, the doctoral candidate, the opportunity to develop the skills of journal article writing as part of the thesis preparation process, and to facilitate the timely publishing of the results from the study after the thesis has been completed.

This thesis by compilation consists of three conventional thesis chapters and five in-preparation journal manuscripts. The target journals were selected because the relevance of this study to their aims and scope. All the journals identified for upcoming submission of the manuscripts are well known peer-reviewed journals whereby the content of this thesis is highly relevant to the journals’ readership. Table 1 provides an overview of the chapters in this thesis and indicates the authorship and publication plan for each of the manuscripts. This is followed by a synopsis of each chapter.

Table 1: Status of chapters and manuscripts

Chapter	Focus and title	Format	Authorship	Target journal
1	Introduction	Chapter	Pranit Anand	Not applicable
2	Literature review: “Using mobile learning to develop independent study skills during outside class time: A Literature review”	Manuscript	Pranit Anand (80%), <i>PhD supervisor:</i> Shirley Agostinho (10%) and <i>PhD supervisor:</i> Sue Bennett (10%)	International Journal of Mobile and Blended Learning
3	Methodology	Chapter	Pranit Anand	Not applicable
4	Design and outcomes of Preliminary Study: “Promoting effective collaboration using mobile technologies across formal and informal learning spaces”	Manuscript	Pranit Anand (80%), <i>PhD supervisor:</i> Shirley Agostinho (10%) and <i>PhD supervisor:</i> Sue Bennett (10%)	Australasian Journal of Educational Technology
5	Design of Main Study: “The design of a program to support students to develop independent study skills through the use of mobile text messaging technology”	Manuscript	Pranit Anand (80%), <i>PhD supervisor:</i> Shirley Agostinho (10%) and <i>PhD supervisor:</i> Sue Bennett (10%)	Journal of Learning Design
6	Results of Main Study: “Using mobile learning to develop self-regulated learning skills”	Manuscript	Pranit Anand (80%), <i>PhD supervisor:</i> Shirley Agostinho (10%) and <i>PhD supervisor:</i> Sue Bennett (10%)	Computers and Education
7	Results of Main Study: “Investigating student experiences with mobile learning”	Manuscript	Pranit Anand (80%), <i>PhD supervisor:</i> Shirley Agostinho (10%) and <i>PhD supervisor:</i> Sue Bennett (10%)	The Journal of Educational Technology and Society
8	Conclusion	Chapter	Pranit Anand	Not applicable

This Introduction chapter explains the context of the study and the structure of this thesis. It presents the background, significance, research questions, methodology, context and limitations of this study, as well as definitions of key terms used. The following description of the thesis chapters provides a brief synopsis of each chapter, indicating if it is a conventional thesis chapter or manuscript, possible outlets for publication and the nature of the contribution of the authors involved in writing the manuscripts.

Chapter Two is presented as an ‘in-preparation’ journal manuscript. It presents the findings from a systematic literature review of empirical studies of mobile learning implementations for the development of self-regulated learning skills, as well as the application of mobile learning in outside class situations. The literature review was conducted using a systematic search procedure where only empirical studies within the last ten years in higher education institutions were selected and a thematic analysis conducted on each of the papers. The manuscript critiques current research in this area and identifies significant gaps in current research and practice. This manuscript was written predominantly by the candidate, with guidance provided from each of the two supervisors. The primary author devised the search strategy and inclusion criteria, undertook all of the analysis, drafted the full text of the paper and made all revisions. The contributing authors provided guidance in literature review methodology, critiqued drafts of the paper, and provided suggestions about writing style and genre. The manuscript will be submitted to the *International Journal of Mobile and Blended Learning*. This journal provides a forum for researchers, practitioners and academics to share research and knowledge about current trends in m-learning and e-learning applications. Among other topics, the journal encourages submissions that are critical or comprehensive reviews of the literature. This journal was selected for this manuscript as it attracts readership from researchers and practitioners who are interested in theoretical and practical ideas about current research on mobile learning and other educational resources.

Chapter Three is a conventional thesis chapter that details the methodology used for this study. The chapter presents the research questions and the theoretical basis for the inquiry, followed by a discussion of the research design, ethical considerations and,

finally, the data collection and analysis techniques. This study was implemented using a two-stage approach: the preliminary study was conducted first and findings from the preliminary study were used to inform the design of the main study. The design and rationale of the preliminary study and the main study is discussed in this chapter.

Chapter Four is presented as an ‘in-preparation’ journal manuscript. It reports on the design and outcomes of the preliminary study that was conducted to test the various technologies used to send bulk text messages to students, and seek feedback from students about their experience of mobile learning. The candidate designed and tested the study program that was used to send text messages to the participants, as well as conduct all data collection and analysis. The results of this preliminary work were used to structure the main study in this research. The candidate completed most of the work on this manuscript from conceptualising the focus of the paper, outlining the structure, drafting all initial text and making all revisions. The research supervisors provided guidance on the focus, content, style and structure of writing, as well as proof reading and critiquing various versions during writing. This manuscript will be submitted to the *Australasian Journal of Educational Technology*. This journal attracts manuscripts, with empirical data, that advance understanding of educational technology in post-secondary education settings. Readers of this journal include researchers and practitioners interested in practical ideas about theoretically informed educational technology implementations.

Chapter Five is presented as an ‘in-preparation’ journal manuscript and provides a detailed description of the design of the study skills development program used in this study. The chapter also describes the theoretical frameworks used to frame this study, as well as explains the implementation of the study skills development program used to engage students using their mobile phones. The manuscript is targeted at other educators interested in using mobile technologies to effectively promote the development of generic study skills using mobile technologies. The candidate completed the majority of the work on this manuscript from identifying the focus, structure, and drafting all initial text and making revisions. The research supervisors provided guidance on the style and composition, as well as proof reading and critiquing various versions during writing. This manuscript will be submitted to the

Journal of Learning Design. This journal was selected due to the journal's focus on sharing research and knowledge on effective design strategies to enable effective learning. The manuscript makes explicit the pedagogical and technical design of a mobile learning implementation to develop first year students independent study skills. Some formatting and refinements may be required to the manuscript to meet the submission requirements of the target journal.

Chapter Six is presented as an 'in-preparation' journal manuscript. It presents the analysis of the data collected to answer the first research question about the effectiveness of using mobile learning to develop students' self-regulated learning skills. It will be of interest to other researchers and educators interested in cost-effective strategies to develop students' independent study skills using mobile learning. The study skills development program used to send text messages to participants was completely designed and tested by the candidate. The candidate also conducted all the data collection and analysis, identified effective ways of presenting and discussing the findings and drafted and made all the revisions of the full text of the chapter. The research supervisors provided guidance on the structure of the chapter, critiqued drafts of the chapter, and provided suggestions about writing style and genre. This manuscript will be submitted to *Computers and Education*. This journal was selected as it attracts readership of educators from a range of educational settings interested in effective implementations of technology to support learning. This manuscript is suited for this journal as it contains theoretical discussion of the implementation and empirical results. It makes a significant contribution towards knowledge about implementations of educational technology to promote effective learning. Some minor formatting and changes may be required to the chapter to meet the submission requirements of the journal.

Chapter Seven is presented as an 'in-preparation' journal manuscript and presents the analysis of data collected to answer the second research question about students' experience with mobile learning in outside class learning situations. It is presented as a research manuscript which will be of interest to other researchers and educators interested in understanding students experiences with using mobile phones for study purposes during their outside class times. This manuscript was written primarily by

the candidate, with guidance provided by the research supervisors. The candidate collected and analysed all the data and identified effective ways to present that findings. The contributing authors provided guidance on the overall style of the chapter and critiqued the drafts of the chapter providing suggestions at various stages of the writing. This chapter will be submitted to *The Journal of Educational Technology and Society*. This journal was selected for publication of this chapter as it attracts readers who are interested in practical issues associated with educational technology and community. The readership includes researchers and practitioners interested in practical ideas about mobile learning. The journal encourages submissions that explore how educational technology implementations influence teachers' and particularly students' engage with learning programs. It is anticipated that some formatting and editing may be required to meet the submission requirements of this journal.

Chapter Eight is a conventional thesis chapter that presents the overall conclusions of the study integrating all aspects of this research study. It presents the findings in relation to the research questions and considers their relation to other relevant research. It includes a discussion of implications for practice, limitations of the study and opportunities for future research.

2 USING MOBILE LEARNING TO DEVELOP INDEPENDENT STUDY SKILLS DURING OUTSIDE CLASS TIME: A LITERATURE REVIEW

Prepared for submission for review as: Anand, P., Agostinho, S., Bennett, S., Using mobile learning to develop independent study skills during outside class time: A literature review.

2.1 Abstract

Self-regulated learning is a topic of much interest in the current climate where more students are entering university from a wider net of backgrounds with significant diversity in preparedness for independent university studies. Self-regulated learning refers to students taking responsibility for their own learning. It involves both motivation to learn and applying a range of cognitive strategies for learning. Although self-regulated learning skills are regarded important for students' success, the development of self-regulated learning is considered an adjunct pursuit to the process of acquiring skills and knowledge associated to enrolled subjects and courses. At the same time there is a significant increase in the uptake of mobile phones among university students as well as use of mobile phones for educational purposes. Mobile phones provide educators with opportunities to engage students in learning regardless of their location.

This paper critiques the empirical research conducted over the past ten years focused on using mobile phones to develop independent study skills among university, and other similar higher education institution, students. This paper also critiques studies done to understand what influence mobile learning have on students' overall learning experiences.

The findings show there are diverse implementations of mobile learning for the development of self-regulated learning skills. There is a lack of evidence in the literature that mobile learning has been used to develop self-regulated learning skills using reliable self-regulated learning instruments appropriately informed by relevant theories. It is also evident from the literature review that the conceptualisations of

outside class mobile learning implementations are very vague. There tends to be a general discussion about how mobile learning can be used to engage students in formal and informal learning, however the definitions about what actually constitutes formal and informal learning is poorly conceptualised. To address this gap, a model for effectively analysing outside class mobile learning using the definitions of formal and informal learning was developed and is presented and discussed in this paper.

This literature review identified inconsistencies in mobile learning implementations for development of self-regulated learning in students outside class time. The findings of this literature review informed the research approach for the development of first year university students' self-regulated learning skills by using mobile phones to engage with students during their outside class times.

2.2 Introduction

A number of large scale studies in Australia and internationally have identified that most first year university students are inadequately prepared to cope with the demands of university study (Duckworth, Akerman, MacGregor, Salter, & Vorhaus, 2009; Kift & Field, 2009; Skene, et al., 2006). A number of studies have further indicated that the first year in higher education experience is generally a critical factor for the successful completion of university courses. Studies (Bamforth, 2010; Dabbagh & Kitsantas, 2004; Jones & Edwards, 2009; Wilson, 2009) have also identified that first year university students need to develop important generic study skills such as goal-setting, help-seeking abilities, self-monitoring, self-evaluation, task strategies and time planning and management. This focus on the importance of first year university occurs in an environment in which universities are experiencing funding cuts that could further reduce their ability to provide effective support to students (Timmis, 2012).

At the same time, higher education institutions are experiencing a growth in the use of wireless mobile devices amongst their student populations (Oliver, 2007).

Accordingly with greater uptake in mobile phones by students, research in the use of wireless mobile devices for education and learning has also increased. Key studies in respect of mobile learning (Bollen, Eimler, & Hoppe, 2004; Dyson, Litchfield, Raban, & Tyler, 2009; Markett, Sanchez, Weber, & Tangney, 2006) have demonstrated that

mobile wireless devices are effective in enabling students to access learning resources conveniently, by using wireless network capabilities that enable users to connect to universities' learning management systems, as well as enabling students and teachers to communicate promptly via text messages, suggesting the possibility of using these devices to allow institutions to better engage learners. Studies have also highlighted the challenges with mobile learning, particularly the distractions posed by seamless access to social media and other non-learning related activities (Bollen, Eimler, & Hoppe, 2004; Dyson, Litchfield, Raban, & Tyler, 2009).

In recent years, although a significant number of research studies have focused on mobile learning generally, a small number of studies have focused on using mobile learning to develop higher education students' self-regulation learning skills, as well as understanding the impact of using mobile devices on students' informal learning activities.

Self-regulated learning is a broad concept that includes a number of skills and abilities (van den Boom, Paas, & van Merriënboer, 2007; Zimmerman, 2000). The Motivational Strategies Development Questionnaire (MSLQ) is a widely used tool to measure college students self-regulated learning skills (Pintrich, 2004, Goh, 2012, Santarosa, 2011, Garcia, 1993). The MSLQ has been used in this study as it has been used reliably in other studies to help identify and develop students self-regulated learning skills (Goh, 2012, Santarosa, 2011, Garcia, 1993). It includes motivations to learn and cognitive learning strategies. The cognitive learning strategies of self-regulated learning comprises the following six components (Pintrich, et al., 1991):

1. Rehearsal: involves reciting, memorising and recalling important terms associated with the learning activities.
2. Elaboration: allows students to form connections between words, ideas and concepts.
3. Organisation: involves using appropriate techniques to form groups of related ideas, selecting main ideas from a topic.
4. Meta-cognition: the ability to apply previous knowledge to new areas to solve problems, make decisions or critically evaluate.

5. Time and study space: involves scheduling, planning and managing study time effectively.
6. Self-effort: the ability to control effort and attention when faced with distractions and disturbances during study.

Although some students develop these skills independently as part of their university study process, most need explicit help developing these skills (Skene, et al., 2006). Some research studies have shown that it is possible to explicitly embed strategies to develop self-regulation skills into instruction (Corno & Randi, 1999; Nisbet, 1991; Schunk & Zimmerman, 1998; van den Boom, et al., 2007). For example, van den Boom et al (2007) encouraged a group of distance education university students in Netherlands to reflect and suggestive feedback about their studies, ultimately enabling them to assume responsibility for their own learning outcomes.

Given that self-regulated learning promotes independence, it is considered as a personal endeavour and an adjunct skill to the skills and knowledge addressed inside class learning; and therefore it can be developed explicitly using outside class learning activities. Nevertheless, students need to be supported with regard to the manner in which they could embed learning strategies in their own study time. Self-regulated learning skills are important skills that students need in order to practice effective personal studies and often are expected to develop these on their own time, often outside of class. The deliberate strategies for the development of self-regulated learning skills in students personal, outside class time therefore opens up debate about the role of formal and informal learning to promote student learning (Sefton-Green, 2004; Colardyn, 2004). Outside class learning is often also referred to as informal learning (White & Martin, 2014).

While informal learning is considered to be learning activities that take place outside a class or institutional structure (Kukulska-Hulme, 2007), different studies have interpreted the concept of formal and informal learning very differently. For example, informal learning can also occur within a formal classroom when students learn skills incidentally. Furthermore, each formal and informal learning implementation can be placed on a continuum between completely formal to completely informal.

Given that mobile technologies can be utilised to connect with students outside of class times, how mobile technology affordances are implemented to support the development of self-regulated learning skills in inside and outside class, formal and informal environments is a timely question to explore, especially with the proliferation of mobile devices amongst higher education student populations. Other authors have also discussed opportunities for research in this area of mobile learning (Schunk & Zimmerman, 1998; Traxler & Kukulska-Hume, 2005). This literature review examines the research that has already been done to use mobile technologies to support the development of self-regulated learning skills in students outside class time.

The following section explains the methodology undertaken to perform this literature review. The findings are then presented which highlight the gaps in previous studies have influenced current research.

2.3 Methodology

To better understand what research has been conducted with regard to the development of self-regulated learning skills for university students in outside class times and spaces, a literature review was conducted to answer the following questions:

1. What research has been conducted for supporting higher education students to develop their independent study skills using a self-regulated learning program delivered using mobile phone technology?
2. What research has been conducted to understand the influence of using mobile phone technologies to provide study support during students' personal, outside class time?

The SCOPUS electronic database was used in this research as it is one of the largest databases of citations and abstracts of peer-reviewed literature on topics ranging from scientific and technical to arts and humanities. Empirical research published within the past ten years (2004-2014) in peer-reviewed academic journals that focus on higher education and adult learning were the focus of this literature review.

Explanation of and rationale for search terms used to inform each research questions are provided below.

1. What research has been conducted for supporting higher education students to develop their independent study skills using a self-regulated learning program delivered using mobile phone technology?

Research studies that focused on the use of mobile learning studies specifically for development of self-regulated learning skills were identified. Search terms used were ‘mobile learn(ing)’, ‘mobile phone learn(ing)’, ‘SMS’, ‘texting’, ‘hand-held learn(ing)’, and ‘ubiquitous learn(ing)’. The results of these searches were combined with key words referring to self-regulated learning such as ‘self-regulated learn(ing)’, ‘generic study skills’, and ‘academic study skills’.

2. What research has been conducted to understand the influence of using mobile phone technologies to provide study support during students’ personal, outside class time?

Research studies that examined the use of mobile devices to promote learning experiences during students’ outside class times were identified. The search terms used were ‘outside class’ combined with ‘mobile learn(ing)’, ‘mobile technolog(y)(ies)’, ‘mobile phone(s)’. All the abstracts were examined manually to ensure they met all the inclusion criteria of being empirical studies, focussed on higher education and peer reviewed. This resulted in only 5 articles being included.

A number of studies from these 5 articles discussed outside class learning together with formal and informal learning, thus the search terms were expanded to include formal and informal learning formal and informal learning as a number of initial articles (Janz, Graetz, & Kjorlien, 2012; Lan, Sung, & Chang, 2014; White & Martin, 2014).

The expanded search terms used now also included ‘formal and informal learn(ing)’ combined with ‘mobile learn(ing)’, ‘mobile technolog(y)(ies)’, ‘mobile phone(s)’.

This expanded search resulted in a total of 110 articles, thus the total number of articles downloaded and examined for the second question was 115.

2.4 Results

For the first research question the initial search resulted in 30 papers, which was reduced to 9 publications after manual examination of each of the papers. For the second research question, the initial search resulted in 5 publications, and an expanded search resulted in a further 110 publications. All 115 publications for the second research question which when manually examined resulted in only 12 publications. The results of the literature review for each of the questions is discussed below:

2.4.1 What research has been conducted for supporting higher education students to develop their independent study skills using a self-regulated learning program delivered using mobile phone technology?

The research produced a result of 30 publications. Each publication was examined to ensure that only studies that focused on the higher education sector (including studies with adult learners, as well as studies that were done within the past 10 years) were included. This resulted in 9 studies which were downloaded and examined in closer detail to identify approaches, patterns and outcomes. These 13 studies were examined guided by the following sub-questions:

2.4.1.1 How was mobile learning used to develop self-regulation learning skills?

This question enabled the identification of various implementations of mobile learning to develop self-regulation skills. It was used to broadly report on the various implementations of mobile learning in the literature.

Self-regulated learning skills involve the ability of students to take responsibility for their own learning. Higher education students, due to their previous study experiences and expectations, often lack the ability to undertake self-study (Kondo, et al., 2012). Initiatives that enable students to interact with appropriate learning activities independent of teacher or other student interventions can help develop students' self-regulation learning skills (Sultan & Mohan, 2012).

From reviewing the 9 articles, four approaches to support self-regulatory learning surfaced which are discussed below:

2.4.1.1.1 Collaborative learning activities

Five studies (Gurtner, et al., 2011; Kovachev, Cao, Klamma, & Jarke, 2011; Laru & Jarvela, 2008; Sanna, Piia, Jari, & Tiina, 2007; Shih, Chang, Chen, & Wang, 2005) explored how to develop self-regulation learning skills by enabling students to collaborate with each other and seek feedback from their teachers and other learners when needed. Activities designed to support self-regulated learning skills included:

2.4.1.1.1.1 Enabling help-seeking from peers in workplace settings

Help-seeking ability is considered an important aspect of self-regulated learning (Gurtner, et al., 2011). Mobile learning was implemented in a workplace apprenticeship learning environment, where the researchers encouraged the apprentices to use their mobile phones to seek help about various workplace tasks from other more experienced workers (Gurtner, et al., 2011). As the apprentices gained confidence working independently, they slowly reduced the time they used seeking help on their mobile phones. In order to understand the development of self-regulation learning skills and participants' perspectives about using their mobile phones in workplace settings, researchers collected recorded voice and text data when participants used their mobile phones in the workplace. In addition, researchers administered a post-activity open-ended questionnaire. Statistical analysis of the participants' usage patterns of their mobile phones indicated a vast majority of requests were help-seeking related communications. Participants indicated that they found the ability to request help as needed was useful and allowed them to complete the allocated tasks effectively.

2.4.1.1.1.2 Collaboration using mind-mapping application, social software and interactive lecture tool on a mobile.

Collaborative learning activities in the form of a synchronous mobile lecture interaction tool, a mobile mind-mapping tool and mobile social software to support virtual learning communities were used with a group of university students in Finland

to help them develop self-regulation learning skills (Sanna, et al., 2007) by scaffolding collaborative activities. The mobile lecture interaction tool enabled students attending a lecture to post questions to the lecturer, comment on other student's questions and vote on answers provided. The mobile mind-mapping tool was embedded in a collaborative learning activity where groups of students identified a lecture topic and collected pictorial artefacts to create a shared mind map about the topic. The mobile social software to support a virtual learning community also enabled students to post artefacts and comments on lecture topics on a shared online website. Researchers collected videos of students using these tools in class, electronic log-files about the usage patterns by the students, post-activity questionnaires and interviews. The data collected indicated that students were very engaged with the learning activities when they used these tools, and that they felt a "feeling of belonging" (Sanna, et al., 2007, p. 73) in the class.

2.4.1.1.1.3 Collaborative reflection and knowledge sharing: uploading photos to a common web site

In a similar study, groups of higher education students in Finland were required to collaboratively reflect and identify significant lecture topics. They then had to look for artefacts within their environment, photograph them on their mobile phones and upload them to a shared website for comment by other learners (Laru & Jarvela, 2008). In-activity video observations and post-activity questionnaires and interviews were also used by the researchers to conclude that the students found the activities both engaging and successful in developing their self-study techniques.

2.4.1.1.1.4 Using mobile phones to record conversations and upload to reflect

Students in a higher education language learning class in Japan were able to use their mobile phones to record conversations and collect other language-learning artefacts using their mobile phones and synchronise these to an online cloud-based platform. They were able to access these artefacts at a later stage using their laptops and desktops, and explore these in more detail through reflection and sharing with other students (Kovachev, et al., 2011). Feedback provided through a post-activity questionnaire elicited students' self-reported perspectives about using the mobile learning environment. The research concluded that students felt that they were more able to delve deeper into their learning.

2.4.1.1.1.5 Custom-made software to scaffold students' learning

Students at a higher education institution in Taiwan were provided with appropriate feedback and relevant scaffolds through custom-made mobile learning software that used students' interaction patterns with the learning software and their learning schedules as determined by their teachers (Shih, et al., 2005). The feedback and scaffolds were provided to the students' mobile phones. Researchers compared the performance scores of students in a control group and experimental group, as well as students' self-reported abilities about their self-regulation learning skills. The students in the experimental group had significantly better performance scores than the students in the control group.

2.4.1.1.2 Independent self-paced activity-based learning

Two studies undertaken by (Kondo, et al., 2012; Sultan & Mohan, 2012) developed self-regulation learning skills by implementing learning activities that encouraged students to undertake independent self-study. These learning activities included:

2.4.1.1.2.1 Custom-made software for language learning

Independent self-study was promoted in a study with Japanese university language learners (Kondo, et al., 2012) where custom-made mobile learning software was developed for the Nintendo DS games consoles. The researchers wanted to ensure that the participating students were working on the learning activities independently and therefore chose a device that did not have communication or internet access functions. The software was designed to enable students to interact with the language-learning software on their Nintendo DS game console and progress through a series of learning objectives as they became able to demonstrate proficiency of various language conventions. Through this activity, students were expected to 'arouse' their interest in self-study, which is a form of self-regulated learning.

Pre- and post-test scores on standardised language tests were compared between a control group and an experimental group. A post-activity questionnaire was also used to obtain feedback from the participants with regard to how they felt about using the learning system outside of class time. The various components of the questionnaire included questions from the Motivational Strategies for Learning Questionnaire

(MSLQ) that measures students' self-regulated learning skills. Comparisons between the control group and the experimental group indicate that the use of the mobile learning software did significantly improve students' test scores, and that the self-regulated learning skills scores of the experimental group were also higher than the control group (Kondo, et al., 2012).

2.4.1.1.2.2 Custom-made software for management of diabetes

Although this study was not conducted with higher education students, it is still deemed useful to be included in this literature review as the participants in this study were adult learners, fitting the general profiles of higher education students.

Independent self-regulation learning skills were developed for a group of adult diabetes patients to help them manage their diabetes without medical staff intervention. Custom-made software was developed for the patients' mobile phones, that enabled them to set personal health goals in consultation with health-care professionals and then "record, review and share" (Kondo, et al., 2012, p. 706) their records with other patients and health care professionals.

Researchers collected data in the form of post-activity focus group interviews, and indicated that there was a need for this type of software and that patients were willing to use the software on their mobile phones. The results did not report the development of self-regulation learning skills among the participants.

2.4.1.1.3 Resources-based or enabling access to learning resources via mobile devices

A study carried out by (Taraghi, 2012) developed self-regulation learning skills by making learning activities and resources available on students' mobile devices as an extension of institutional learning management systems. Students were able to use their mobile phones to access learning resources normally only accessible through the university's online learning management system.

Mobile learning software was developed that allowed students to access all commonly used learning resources via their mobile phones. The software was an extension of their online learning environment where various online learning tools were made accessible by a personal learning environment on students' mobile phones. Data

collected in the form of quantitative usage patterns of various tools and parts of the software were purely for the purposes of informing the researchers about the functionality of the software, not the self-regulation learning skills (Taraghi, 2012).

2.4.1.1.4 Contextual time management using mobile scheduling and calendar applications

A study conducted by (Yau, Joy, & Dickert, 2010) developed self-regulation learning skills by managing students' learning schedules using calendar applications available on all modern mobile phones (smartphones). Their custom-made software used students' calendar entries to identify their context, that is, what they were doing. This information was used to provide relevant learning material to students' mobile phones.

Modern mobile phones contain advanced calendar and scheduling applications, however students may not necessarily keep these updated in line with their learning and other study related schedules. In a study aimed to provide relevant learning resources based on students' context, Yau et al (2010) used a traditional paper-based diary to first develop consistency in recording up-to-date schedules and then to enter these manual diary entries into their mobile phones' calendar applications. This was then used by their custom-made software to provide relevant learning materials and support to students based on their context in their calendar. Although the researchers claimed that the activity would enable students to develop self-regulation learning skills, data collected in the form of diary entries and a post-activity questionnaire did not seek to find out about the development of self-regulation learning skills, but instead was used to ascertain the effectiveness of using the calendar applications as a suitable indicator of learning context.

A summary of the various implementations of mobile learning to develop self-regulated learning is provided in Table 1 below:

Table 2: Summary of mobile learning to develop self-regulated learning skills

Focus area	Description	Learning theories	Examples of studies
Collaborative learning activities	Students participated with other students and teachers while working on learning activities designed to develop self-regulation learning skills	Collaborative learning Self-regulated learning	(Gurtner, et al., 2011; Kovachev, et al., 2011; Laru & Jarvela, 2008; Sanna, et al., 2007; Shih, et al., 2005)
Independent learning activities	Developed self-regulation learning skills by providing appropriate learning activities that encourage students to undertake self-study at appropriate times	Self-regulated learning Activity theory	(Kondo, et al., 2012; Sultan & Mohan, 2012)
Resources-based	Developed self-regulation leaning skills by making learning activities and resources available on students' mobile devices as an extension of institutional learning management systems	Self-regulated learning	(Taraghi, 2012)
Time-management	Developed self-regulation leaning skills by making learning activities and resources available on students mobile devices as an extension of institutional learning management systems	Self-regulated learning Scaffolding	(Yau, et al., 2010)

2.4.1.2 What role did existing self-regulated learning theories play in the development and evaluation of mobile learning activities?

The development and evaluation of self-regulated learning is a complex process; basing mobile learning implementations within appropriate theories that have been used and tested by previous studies and implementations ensures greater reliability with the learning activities and outcomes.

Exploring the literature highlights the diverse implementations of mobile learning to develop self-regulation skills. Similarly, the studies varied in their approaches to adopting self-regulated learning theories in their implementations and evaluation of the studies.

Regardless of the specific definition, all theories on self-regulated learning suggest that students need to take responsibility for their own learning. They include a number of learning processes including goal-setting, planning, time-management and reflective practice (Kondo, et al., 2012; Sanna, et al., 2007). Teachers and other educational support can be used to provide appropriate scaffolds to enable students, through determined and deliberate interaction with the learning activities, to develop these self-regulation learning skills. All 9 studies retrieved through this literature search discussed using mobile learning in various forms to develop self-regulated learning skills, however the studies varied in the approaches used to influence the design of the mobile learning activities, as well as the evaluation of the activities to see if there was an impact on self-regulation learning skills. Only 2 of the studies in this literature review were identified as having used a structured theoretical approach to the development of self-regulated learning skills (Kondo, et al., 2012; Shih, et al., 2005).

A three-phase cycle of self-regulated learning was used in a study with a group of Japanese university students who were studying to undertake the Test of English for International Communications (TOEIC) (Kondo, et al., 2012). The three phases included forethought, performance control and self-reflection. Custom-made mobile learning software was developed for the Nintendo DS Lite games console to reflect these three phases. Students used the mobile learning software independently, to develop self-regulation learning skills while preparing for their TOEIC tests. The Motivational Strategies for Learning Questionnaire (MSLQ) was used to develop valid instruments to measure students' self-regulation learning skills at any point in time. A post-activity questionnaire was developed using aspects of (MSLQ) (Kondo, et al., 2012) to measure the student's ability to self-regulate their learning at that point in time. Although there was no comparison between pre- and post-study MSLQ

scores, by comparing scores of students from a control group, results indicated that the students in the experimental group had higher MSLQ scores.

A similar study was undertaken by Shih et al (2005) in which custom-made software was developed for students' mobile phones using a four-phase cycle for self-regulated learning which included goal-setting and strategic planning, strategy implementation and monitoring, strategic outcome monitoring, and self-evaluation and monitoring. Students interacted with the mobile learning software and the learning materials provided to develop their English language skills. The software also allowed students to self-assess their skills based on the subject expectations as established by their subject instructor. Self-regulated learning skills were developed by enabling the mobile learning software to provide appropriate learning materials and resources based on students' learning schedules according to their subject learning requirements.

Although no explicit self-regulated learning theories were referred to in another study used to develop individual and collaborative learning practices through three experiments at a higher education institution in Finland (Sanna, et al., 2007), the study implicitly applied the general conventions of self-study conceptualised by all self-regulated learning theories. In the first experiment a mobile lecture interaction tool enabled students to post, comment and vote on questions while attending the lecture. Similarly, a mobile mind-mapping tool enabled students to collaborate with other learners to identify and discuss lecture concepts through pictorial representations of those concepts. Finally, the formation of a virtual learning community was encouraged through group work supported by social software. In all three cases, support to regulate students' learning was provided through collaboration with their instructors as well as with other learners.

Self-regulation skills have been developed in all studies by putting appropriate support in place to enable students to develop appropriate, independent self-study behaviours. Over time it is expected that students will become less reliant on these supports and be able to structure their learning independently.

Although valid instruments are available to measure students' ability to self-regulate their learning, none of the studies examined as part of this literature review used them as a pre- and post-test measure to identify levels of self-regulation learning skills and observe the impact of the learning activities on the individual student's self-regulation learning skills.

2.4.1.3 To what extent were the studies integrated with existing teaching and learning activities?

Students can use their mobile phones to support their learning without any explicit expectations from the faculty to do so. In order to effectively monitor and evaluate mobile learning implementations, the necessary processes had to be as tightly integrated as possible within teaching and learning activities.

Although the studies in this literature review were theoretically driven, they lacked integration with existing teaching and learning strategies of the courses and subjects that the students were enrolled in.

Mobile learning is more likely to succeed if it is strategically aligned with existing teaching and learning activities (Rapetti, et al., 2011). Students are more willing to participate in mobile learning activities if they can clearly identify a clear connection between mobile learning and their classroom activities. Students' engagement and performance outcomes have been reported to be much higher when their mobile learning activities are an extension of their subject or course-related learning activities (Sanna, et al., 2007; Shih, et al., 2005).

Higher levels of performance were observed from students who used custom-made software on their mobile phones that delivered appropriate learning materials and support provided by their teacher based on their learning schedules (Yau, et al., 2010). Students were able to interact with the software to self-assess their abilities according to their subject and teacher's expectations. The learning materials and schedule were created and set up by the subject teacher/instructor for different sections of the subject. Students' performance in standardised tests indicates that the results of students from the experimental groups were much better than students from control groups.

Similar observations were reported when students used mobile phones as a mobile lecture interaction tool, mobile mind-mapping tool and a scaffolding tool to support collaborative learning via social software (Sanna, et al., 2007). The mobile lecture interaction tool enabled students to use custom-made software developed for asking questions, commenting on answers and voting on questions and comments in a lecture using smartphones. The mobile mind mapping enabled students to take pictures of artefacts from around their campus to support concepts discussed in class. For this activity, students were first divided into small groups in the classroom and asked to identify concepts amenable to illustration by way of images. Student's pictures were uploaded onto the mind-mapping site and available for comment and discussion for the next class. The mobile scaffolding tool, designed to support collaborative learning, enabled students to attend lectures and then within their small collaborative learning groups, identify important themes to pursue for exploration within their group. The students would then take pictures and videos of artefacts that fitted the identified themes and through further discussion and critique, form knowledge about the themes. Through video observations (while students were participating in the learning activities), interviews, questionnaires and analysis of students' work, it was identified that students had high levels of engagement, increased levels of reflective practice and had a sense of belonging.

Students demonstrated significant improvement in standardised English language tests when they used mobile learning even though it was not directly aligned with the teaching and learning activities. The custom-made mobile learning software for DS Lite games consoles enabled students to prepare for and rehearse their TOEIC English tests. Pre- and post-test scores were compared for experimental and control groups and a post-test questionnaire was used to determine whether using the mobile learning software influenced students' self-regulated learning skills. Although the students were free to use the mobile learning software as they wished, the results indicate that TOEIC test scores improved more than the control group (Kondo, et al., 2012). However, in the same study, students' independent use of the mobile learning software decreased when they were not preparing for their TOEIC tests, and therefore the test scores were lower.

Engagement can be difficult to determine. Students who feel engaged tend to suggest that they feel a sense of belonging (Sanna, et al., 2007). Studies that identify engagement also report better performance (Gurtner, et al., 2011; Sanna, et al., 2007; Shih, et al., 2005; Yau, et al., 2010), although better performance does not necessarily mean better engagement (Kovachev, et al., 2011; Sultan & Mohan, 2012; Taraghi, 2012).

2.4.2 What research has been conducted to understand the influence of using mobile phone technologies to provide study support during students' personal, outside class time?

The initial results of 115 studies retrieved to answer this question was further refined manually to only include studies conducted within the higher education sector and adult learners, and conducted within the past 10 years. Based on this, a number of studies were eliminated because they were done within primary and high school sectors, resulting in a final list of 12 articles which were downloaded and examined in closer detail.

The papers retrieved highlighted that there is no consistent definition of outside class, formal and informal learning. The majority of the literature tends to discuss all outside class learning as informal learning and all inside class learning as formal learning. In fact, most of the studies also indicate that there is a lack of a sophisticated understanding about what constitutes formal or informal learning. By analysing the studies that implemented various forms of inside class, outside class, formal and informal mobile learning, it was possible to conceptualise a comprehensive framework for formal and informal learning, which includes inside and outside class learning definitions, based on intent and structure of the learning. Learning activities can be designed to be highly intentional or completely ad hoc without any clear intentional objectives. At the same time, learning can occur within a highly structured environment such as a classroom or in a completely unstructured environment such as a rain forest. High structure and high intent indicate very formal learning, whereas low structure and low intent indicate very informal learning. Outside learning is

generally all learning that takes place outside the class, it can be either formal or informal.

The majority of the studies conceptualised informal learning as learning that occurs outside the classroom, however informal learning can extend to learning unintended concepts and skills while participating in learning activities inside the classroom. Understanding formal and informal learning is still evolving. This literature search produced 12 results of studies that implemented mobile learning across formal and informal learning spaces and approaches, however, closer analysis of these studies indicate much more diversified interpretations and understandings of what constitutes formal and informal learning.

Formal learning is generally defined as all learning that takes place within a classroom or institutional setting (Kukulska-Hulme, 2007). Normally, in a formal learning environment, students participate in learning activities that are effectively managed by the teacher within classrooms or other structured physical spaces designed for learning and teaching. This structure enables teachers to ensure distractions are minimised and pre-determined course goals are achieved and measured through various testing and evaluation strategies. Learning activities within this environment tend to be well received by the students as they can see explicit connections with the subject and course objectives (Rapetti, et al., 2011).

Informal learning on the other hand is generally considered as learning activities that take place outside of classroom settings (Kukulska-Hulme, 2007). These activities can be highly engaging and effective for students due to the authentic nature of learning. A number of these informal learning activities may still be linked to subject and course objectives.

Although these definitions of formal and informal learning are useful, they are shallow as they do not effectively define the full spectrum of the possible formal and informal learning implementations. For example, even in a formal learning environment where students participate in controlled learning activities within a classroom, students often do acquire unintended skills such as cultural awareness or intercultural communication skills. On the other hand, in outside classroom learning,

informal learning activities can be very tightly controlled. In this situation, students learn content which is planned and managed, minimising opportunistic learning and therefore it can be argued that the learning is actually very formal.

Sefton-Green (2004) suggests that the structure of learning refers to the physical spaces and environments where the learning takes place. For example, in-class learning tends to be considered as highly structured, whereas outside classroom learning activities are considered to be less structured. A learning activity that is conducted completely outside a classroom and institutional setting would be considered to have low structure and would therefore be considered as informal. A learning activity conducted inside the classroom would be considered to be highly structured and would therefore be considered as formal. Mobile learning implementations can be positioned anywhere on this low-high structure continuum depending on the level of structure used.

Intent, on the other hand, refers to the extent to which learning activities are created according to intended outcomes and course goals. Learning activities that are highly intentional tend to be formal and learning activities that have low intentions are considered to be informal. Once again, a typical mobile learning activity can be placed anywhere on this continuum of low to high intent. Students can participate in learning activities outside the classroom. The activities, however, may be very intentional in terms of what the students need to be able to participate in the activity and the reasons for so doing (Kekwaletswe, 2007), although, in this example, the learning activities are informal in terms of structure, but formal in terms of intent.

Formal and informal learning can thus be defined as a continuum between structure and intent but even then it may not be clearly defined. For example, students often start an activity inside the classroom, and then move outside for independent, situated learning activities and then bring various artefacts collected outside to be discussed inside the classroom (Abdullah, et al., 2013; Ros i Solé, Calic, & Neijmann, 2010). In these examples, students are moving between the domains of structure and intent.

Conceptualising formal and informal learning using the structure and intent domains seems to provide a meaningful basis for understanding various implementations of learning, particularly mobile learning, which attempts to engage students in outside class activities. Students' involvement in the mobile learning activities can vary through formal and informal spaces and settings at various times within a single learning activity. For example, in a number of studies (Abdullah, et al., 2013; Ros i Solé, et al., 2010) that explored informal learning with second language learners, students were required to explore lecture concepts covered in class and then go outside and choose and share artefacts that supported the lecture concepts, using their mobile phones. These were then discussed in the classroom with other students. These students started their study within high structure and high intent environments, and then moved on to low structure but the intent was still very high. In this sense, students were allowed to formulate their own intent in what they collected and during this part of the activity the overall intent was low.

As part of this literature review a comprehensive framework was developed to evaluate various mobile learning implementations based on the structure and intent domains. This enabled each of the studies examined to be placed within a continuum of formal and informal learning, and therefore better understand the motivations of students to participate in the studies.

A Likert scale was created where 1 rated completely informal and 10 rated completely formal. Each of the studies was given a rating on this Likert scale for each of the intent and structure domains based on how formal and informal they were according to the intent and structure of the learning activities that were implemented. Table 2 indicates the structure and intent ratings for the studies used in this literature review.

Table 3: Structure and intent ratings

	Intent	Structure	Focus
(Timmis, 2012)	8	5	Use of instant messaging to provide peer support between students enrolled in an undergraduate course
(Comas-Quinn, et al., 2009)	3	1	Use of mobile blogs in language learning in outside class environments. Students were able to identify aspects and blog about their experiences when they were situated in outside class environments.
(Abdullah, et al., 2013)	10	4	Students scaffolded in a language learning course by providing relevant support via mobile phones.
(Andrews, et al., 2010)	10	5	Students in health sciences use of mobile phones to support their learning through customised rich media software for various topics.
(Ros i Solé, et al., 2010)	5	5	Mobile assisted language learning using context-sensitive and social-oriented approaches. Students were supported to develop their language skills through reflection and discussion.
(Breuer, Konow, Baloian, & Zurita, 2007)	9	2	Collecting and documenting outside class learning experiences and bring them for discussion inside classroom.
(Gu, Gu, & Laffey, 2011)	10	1	Mobile learning to promote and support life-long learning. Citizens were provided access to mobile learning on a range of real-life situations.
(Rapetti, et al., 2011)	2	2	Studies how and under what situations students use their mobile phones for learning.
(R.M. Kekwaletswe, 2007)	8	2	Social presence to support learning as students moves between study locations, ensuring that learning have access to relevant support in all study locations.
(Patrick, Josie, & Doug, 2010)	9	6	Collaborative learning between students using mobile technologies. Students participated in structured learning activities.
(Fallahkhair, Pemberton, & Griffiths, 2005)	10		Language learning through the use of custom-made software utilising students' mobile phones and interactive television in their own time, outside of class.
(Kukulska-Hulme, 2009)	9	5	Games based language learning using mobile technologies.

Each of the studies implemented mobile learning to explore the boundaries between formal and informal learning, however the implementations varied significantly based on the interpretations of formal and informal learning.

The chart in Figure 1 provides a pictorial representation of where all the studies fit within the structure and intent formal and informal learning continuum. Each of the diamonds represents a study in the literature review and is placed within the informal and formal space as evaluated by the intent and structure ratings.

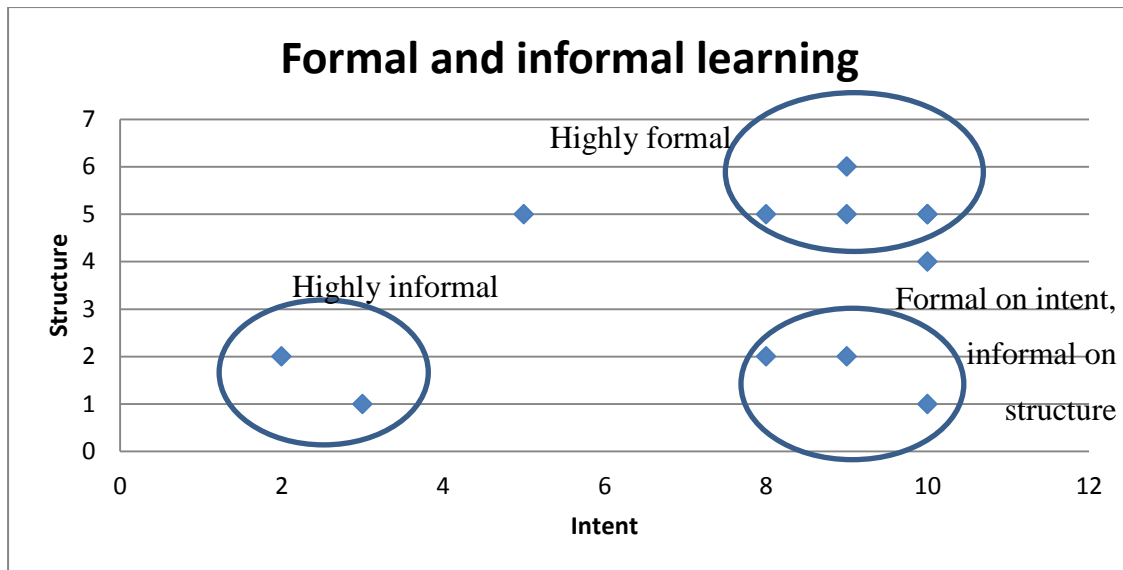


Figure 1: Plots of formal and informal learning in this review

It is clear from figure 1 that although studies attempted to implement mobile learning to understand formal and informal learning, the majority of the studies were within the formal learning domain. Two studies were identified as significantly informal in both the structure and intent domains compared to all the other studies (Timmis, 2012; Comas-Quinn, et al., 2009). In one study (Timmis, 2012) mobile learning was implemented to enable second language learners to learn language in real-life settings through serendipitous encounters with other learners, people and objects. Although this study was conducted within an intentional course, the teachers were not involved in what, how and where the learning took place. Students in this study were also learning outside the classroom and were expected to set their own learning goals and then take actions to achieve those goals. They did not have access to the teachers or any other support during this time. Although evaluation of this course indicated that activity was well received by the students, it also identified that their participation was extremely low. The research concluded that the lack of integration of the activity with an existing teaching, learning and assessment activity resulted in the students not engaging with the activity as much. In another informal study (Comas-Quinn, et al., 2009) mobile learning was not embedded in any course content, but it attempted to study and understand students' use of mobile phones to support learning. The study surveyed higher education students on ways in which they use their mobile phones and how their phones are used to support their learning. This study identified that

students will not automatically use their mobile phones to support their learning unless there is a clear connection between mobile phone use with teaching and learning activities and objectives. The researchers suggest that the teaching and learning activities must be designed to explicitly include mobile phone use.

The studies that can be considered more formal than others in this literature review were significantly more formal on the intent domain compared to the structure domain (Abdullah, et al., 2013; Andrews, et al., 2010; Kukulska-Hulme, 2009; Patrick, et al., 2010; Timmis, 2012). It is comparatively easier to conceptualise informal learning according to structure, for example studies (Comas-Quinn, et al., 2009; Gu, et al., 2011; Ros i Solé, et al., 2010) that enable students to move outside the classroom to work on learning-related activities that have clearly defined objectives. Since the students were working on the learning activities outside the classroom it is considered as informal learning according to the structure domain, however since the learning activities did not give students complete freedom to act completely independently of the learning objectives of their course, the learning activities were considered to be very formal, according to the intent domain. During the evaluation of this mobile learning activity, the researchers reported higher levels of engagement compared to studies that were considered informal in both intent and structure. Students indicated that because they were able to see a clear connection between the mobile learning activities and the course objectives, they felt more inclined to take part in the activities. Students need to see a clear link between the learning activities and the course objectives, even though they do acquire a number of 'soft skills' that were not explicitly planned by the teachers.

The majority of studies as listed in Table 3 in this literature review cannot be defined as formal or informal with respect to both the structure and intent domains, however these studies tend to be high on intent, that is, they have very formally-defined learning objectives, and are low on structure. They are therefore classified as formal on intent and informal on structure.

In all of these studies the objectives were clearly defined within a course and students interacted with the learning activities via their mobile phones to achieve the defined

objectives. The study conducted by Gu, et al (2011) promoted life-long learning by developing custom-made real life learning modules such as ‘how to change a car tyre?’ which enabled learners to access learning materials using their mobile phones when needed. The learning activities in this study were clearly informal on structure but formal on intent to the extent that the learners had to interact with the set learning modules.

2.5 Discussion

This literature review was conducted to answer the following questions:

1. What research has been conducted for supporting higher education students to develop their independent study skills using a self-regulated learning program delivered using mobile phone technology?
2. What research has been conducted to understand the influence of using mobile phone technologies to provide study support during students’ personal, outside class time?

Although the literature search produced results that were successful in illuminating some ideas and clarifying certain misconceptions about the initial understanding in regard to both of the research questions, there were clear gaps in the way learning strategies were implemented, as well as conceptualisations about the topics themselves.

2.5.1 No measureable evidence of improved self-regulatory skills

Whilst studies were focused to promote self-regulated learning skills, none of the studies in this literature review actually measured whether their activities clearly contributed to the development of these skills in their students. Although various studies (Kondo, et al., 2012; Sanna, et al., 2007) referred to instruments that have been used in other studies to identify individual self-regulated learning skills, these instruments have not been used in any of these studies. This is not a criticism about these studies, rather that they were not designed to measure the development of self-regulated learning skills. Self-regulated learning generally consists of a number of related skills. Students, therefore, can have different levels of competencies for each of the skills and identifying these unique competencies can lead to more targeted strategies to develop self-regulated learning skills.

Although each of the skills that form part of the self-regulated learning skills set has appropriate strategies to help students develop their competencies, to assess whether these strategies have been effective should involve studies that utilise a pre- and post-activity diagnosis to indicate the pre- and post-competency levels. Other studies (Kondo, et al., 2012; Sanna, et al., 2007) used a number of these tools to identify the post-learning activity self-regulated learning competencies but did not have pre-activity data to identify any improvements. For example in a collaborative learning activity (Sanna, et al., 2007), researchers used post-activity questionnaires to explore students' self-reported competencies, whereas in another study designed to help second language learners develop self-regulated learning skills (Kondo, et al., 2012), the researchers use a post-activity MSLQ scores to gauge the competencies of their participants.

2.5.2 Rudimentary conceptualisations of mobile learning

Most of the literature conceptualised informal learning as learning that occurs outside the classroom. Although this is an important and useful concept, it does not effectively describe the full spectrum of learning that occurs inside class as compared to outside class. Informal learning can also take place within a classroom, for example when students participate in unintended discussions and, in the process, learn skills such as interpersonal communications or intercultural understanding. Even within this definition of informal learning where students learn outside the classroom, many learning activities require students to move outside the classroom after initiating certain aspects of the learning activity inside the classroom. This indicates that it would not be appropriate to classify these learning activities as purely formal or informal, but rather to place them on a scale between formal and informal.

Similarly, learning that occurs outside the classroom, although often simply classified as informal, may not actually require students to participate in explicitly designed learning activities to achieve identified learning objectives. In these examples, it would be inappropriate to classify this learning as informal and it would be more appropriate to place it on a scale between formal and informal.

Although informal learning is well suited to help students develop self-regulated learning skills, none of the studies explored in this literature review delved into informal learning to develop self-regulated learning skills. Mobile learning generally is well suited to engage students in their informal times and spaces. Informal mobile learning is also well suited to help students develop self-regulated learning skills; however none of the studies from this literature review used informal mobile learning to develop self-regulated learning skills.

Formal and informal learning, therefore, are more appropriately defined using a continuum on structure and intent domains. This conceptualisation is more useful as it better reflects formal and informal learning through the structure and intent domains of the mobile learning activity. Apart from these incomplete conceptualisations about formal and informal mobile learning, studies made no attempts to explain the learning experiences and outcomes of students who participated in these formal and informal mobile learning activities. Studies designed and implemented various mobile learning activities for informal learning but did not explore the impact of crossing these traditional boundaries on students' learning experiences and more importantly, on the learning outcomes.

The literature review highlighted the lack of consistent conceptualisations of formal and informal learning. The domains of *intent* and *structure* that has been used in this paper to review and analyse research conducted in the area of formal and informal learning can be effectively applied to understand the degree of formal and informal learning for each learning activity.

The intent of a learning activity refers to how closely it is aligned with the identified objectives of a course or subject. For example, highly intentional activities are when students participate in learning activities that has been designed to ensure study meet stated learning objectives. These activities can be inside or outside class. Similarly, learning activities that are not prescribed by stated course objectives tends to be regarded as having low intent. Therefore a learning activity that is highly intentional is considered formal and learning activities that are not prescribed by pre-identified learning objectives tend to be informal.

The structure of a learning activity refers to the physical environment where the learning takes place. For example, a classroom or lecture theatre is considered highly structured place, whereas learning activities that take place outside of class like parks and gardens are regarded as low structured activities. Highly structured learning activities are regarded as formal and low structured learning activities are regarded as informal.

The ubiquitous nature of mobile phones makes it ideally suitable to be applied for informal structured activities, that is, learning activities that takes places outside class in real situations. However, creating informal intent learning refers a lot more careful consideration. Existing mobile learning activities can be effectively analysed using these intent and structure domains to get a better understanding about the way in which mobile phones enables crossing the boundaries between formal and informal learning. Learning activities can be placed within a continuum from extremely informal to extremely formal on each of the domains of *intent* and *structure*. The figure 2 below demonstrated the quadrants of formal and informal learning that is a suitable way to place learning activities within the formal and informal learning continuums.

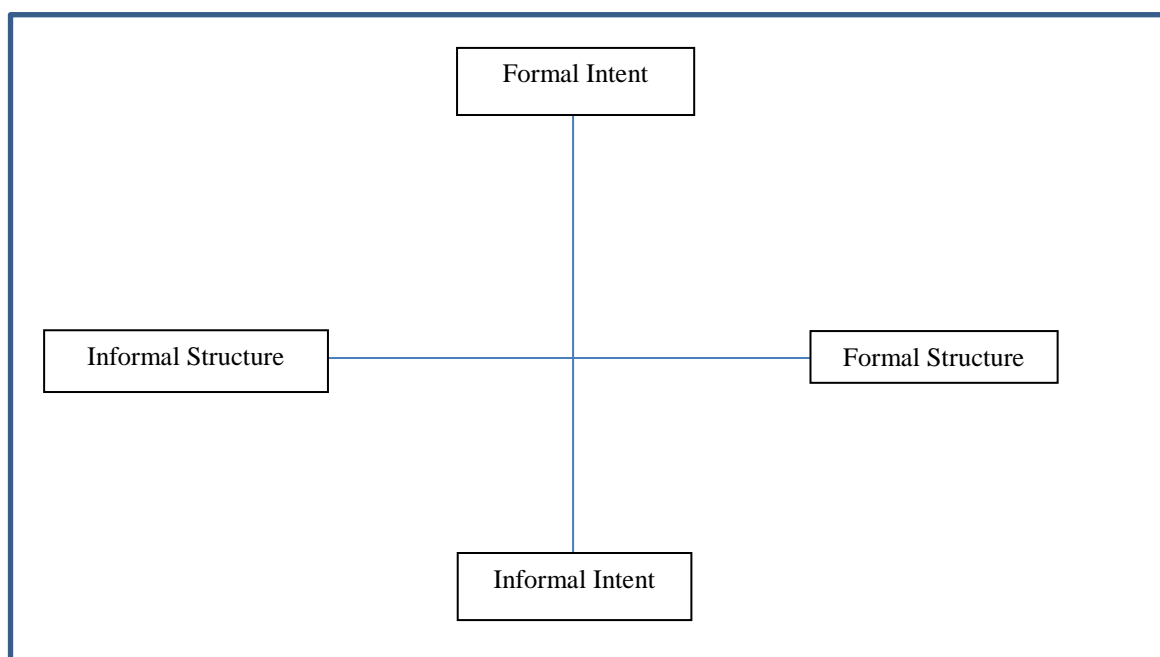


Figure 2: Quadrant of formal and informal learning

2.6 Conclusion

This literature review paper critiqued empirical research conducted over the past ten years on using mobile learning to develop first year higher education students' self-regulated learning and understanding the influence of mobile learning during outside class time on students' approaches to learning. The findings of this structured literature review indicate that there is a lack of evidence in the literature about the use of measurable evidence of improvement of self-regulated learning. Although self-regulated learning can be developed by participating in various learning activities, use of widely used tools to measure students' self-regulated learning skills before and after a learning program provides more reliable evidence.

This literature also highlighted that there are rudimentary conceptualisations of formal and informal learning. Outside class learning can be conveniently referred to as informal learning, however, depending on the alignment of the learning activities to stated objectives; it may still be considered formal. Learning activities therefore, can be placed on a continuum between formal and informal depending on the domains of intent and structure.

This critique of literature highlights the need for further research needs to be conducted where self-regulated learning skills are developed for individual needs of each student, given that students' competencies across the different study skills may be different and therefore the needs to develop these skills would be different. Mobile devices provide an ideal opportunity to address these unique individual needs due to the personal nature of these devices. Existing studies also suggest that the development of self-regulated learning skills can be effectively promoted through informal learning activities; however future research should be able to explore students' experiences in engaging in informal mobile learning activities.

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3 METHODOLOGY

3.1 Introduction

This chapter describes the methodology for this study that investigated how mobile phones could be utilised to promote the development of self-regulation skills among first year university students by engaging them to practice appropriate study behaviours outside of class times. More specifically, the research aims to investigate:

1. how can first year university students be supported to develop their independent study skills using mobile phone technology?
2. how does the use of mobile phone technology influence first year university students' engagement in learning outside class?

This chapter presents a discussion of the research approach and the particular design used, ethical considerations and the data collection and analysis techniques. The study was implemented using a two-stage approach: the preliminary study was conducted first, and findings from the preliminary study were used to inform the design of the main study. The design of the preliminary study is also discussed in this chapter.

3.2 Research approach

Studying the development of self-regulated learning skills is a complex process (Dabbagh & Kitsantas, 2004; Nota, et al., 2004). It involves understanding effective learning behaviours and how these behaviours influence improvements in learning outcomes. A case study methodology (Yin, 1993) was employed for this research to investigate how mobile devices can be used to promote learning across inside and outside times and spaces in higher education. Case studies are suitable ways in which study skills development programs of this kind can be observed because they enable researchers to observe the effect of using mobile learning to promote the development of self-regulatory learning skills on students learning.

Case studies have been used in previous studies to understand complex educational concepts. For example, Jones and Edwards (2009) used case studies in their research to try to understand the phenomena of using SMS messaging to support student learning in large undergraduate classes. Quantitative and qualitative data from surveys, questionnaires, student feedback via text messaging and reference to the

literature were used to understand the impact of the interventions on students' learning experiences. In another case study designed to understand the complex area of using mobile technologies for assessment and learning in clinical practice settings (Dearnley, Haigh, & Fairhall, 2008), qualitative and quantitative data were collected through questionnaires and focus group interviews. Data from different sources were amalgamated and analysed to understand the readiness and impact of using mobile technologies on teachers and students.

A case study was deemed a suitable methodology for this study as it enabled the researcher to observe participants in a naturalistic setting and provide a rich understanding of the way in which students used their mobile phones for study (Yin, 1993). As part of this study, both qualitative and quantitative data were collected to enable the researcher to obtain a comprehensive understanding of the impact of using students' mobile phones for the development of self-regulated learning skills.

“Qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible, qualitative researchers study things in their natural settings.” (Mertens, 2005, p. 229) Qualitative data can provide rich understandings about complex phenomena such as students' study behaviours and experiences. In order to effectively answer the research questions in this study, students' feelings, values and perceptions had to be understood in order to determine if the study skills development program used influenced the outcomes. The research needed to be conducted in naturalistic settings and its impact gauged utilising measurable outcomes. Understanding the development of self-regulated learning skills requires careful evaluation. Students can sometimes develop these skills as part of their study practices at university, however, by studying students' perceptions and feelings through rich feedback, it was possible to understand if the interventions developed and used in this study positively influenced students' self-regulated learning skills.

Given the nature of this research, where it is important to understand the study behaviours of students, it was important to measure if the initiatives did actually have a positive impact on students' outcomes and therefore qualitative tools to measure

outcomes were also employed. Purely understanding students' feelings, values and experiences may not provide enough information to evaluate the effectiveness of using mobile phones to develop students' self-regulation skills. Using quantifiable measurement tools to gauge the development of self-regulation skills provides a concrete baseline which can be utilised to understand the students' experiences participating with the study skills development program used in this study.

Further, using a case study approach is also appropriate for studies in which the researcher systematically designs learning materials based on instructional theory, and wishes to evaluate its implementation in a natural setting (Briggs, 1984; Reigeluth & Frick, 1999). This approach offers a means for investigating and furthering theories of instruction that operationalise learning theories. This research falls into this category and as one of its key outcomes intends to contribute to design principles and practical strategies for text messaging and mobile learning more broadly to develop independent study skills.

The overall timeline of the research process is outlined in Table 5 below:

Table 4: Research timeline

Date/timeframes	Description/milestones
2008 to 2009	<p>Master of Education (Research Project)</p> <p>Focus: Investigate how the location awareness feature of wireless mobile devices could be used to support collaborative and reflective learning</p> <p>Ethics approved (see appendix A)</p> <p>Outcomes: Feasibility study of location-awareness of mobile devices indicated that the technical requirements were not available for mainstream implementation with higher education students' personal devices thus the study was refined to focus on the use SMS technology.</p>
2010	<p>Re-submit ethics application addressing new research focus with SMS technology for collaboration and reflection in terms of self-efficacy.</p> <p>Configuration and testing of SMS gateway</p> <p>Development of online self-efficacy rating scales and surveys</p> <p>Data collection and analysis of pilot study</p> <p>Master of Education (Research) upgraded to Ph.D study.</p> <p>Findings documented in Chapter 4</p>
2011 to 2013	<p>Implementation and analysis of main study</p> <p>Focus: A more concentrated focus on reflection skills by investigating self-regulated learning.</p> <p>Findings documented in Chapters 5, 6 and 7</p>

3.3 Research design

The inquiry process of this study was designed and implemented in two stages: the preliminary study and the main study. Sending and receiving single text messages is considered convenient and a relatively easy process, however, sending bulk text messages requires careful planning and utilisation of appropriate technologies. The preliminary study was designed to implement and test the technical infrastructure required for sending and receiving bulk text messages. It was also designed to get a sense of student's experiences in receiving study-related text messages in their out-of-class times and the impact of text messages on students study behaviours. The main focus of the preliminary study was to inform the design of the main study about the technical feasibility of using bulk text messages to support students learning. The main study was designed to understand the impact of targeted text messages on students' self-regulation learning skills and their reactions to mobile learning outside of class. The design of each of these studies is described in more detail as follows:

3.3.1 Preliminary study

The aims of the preliminary studies were to:

1. design, implement and test the technology required to send and receive bulk text messages.
2. understand student reactions to receiving study-related text messages during out-of-class times.
3. develop an initial understanding the impact of using targeted, persuasive text messages on students' learning behaviours.

3.3.1.1 Participants

All students enrolled in a first year introductory educational technology subject in the Bachelor of Education program at the University of Wollongong were invited to participate. Of a total subject enrolment of approximately 350 students, 224 volunteered. Of these, eight withdrew about midway through the study and were removed from the mobile phone database, leaving 216 participants in total.

3.3.1.2 Design and implementation of mobile learning activity

The timing of this study coincided with a major change in the teacher education program in which it would be conducted. Between the preliminary study and the main study the subjects changed significantly and so it was not possible to repeat the main study in the same subject because it no longer existed in the same form. Further, to encourage participation of subject coordinators, one of the principles of this research was that the study skills development program would be directly relevant to the needs of their students and designed in collaboration with them. This meant that the study skills development program developed for the two phases had slightly different foci. So while the main study would focus on self-regulated learning skills, the preliminary study focused on how mobile devices could be used to promote peer learning within a first year pre-service teacher university subject.

A study program was developed and implemented whereby participants were paired and sent a number of text messages over a four-week period with the aim of helping them to study a topic that was covered in the subject. The study program was implemented from Weeks 8 to 11 of the 13-week semester in a first year introductory

educational technology subject in the Bachelor of Education program at the University of Wollongong.

The design of the program was based on Vygotsky's Zone of Proximal Development theory (Hogan & Tudge, 1999) to match students for peer-learning activities based on their self-efficacy scores, as well as to gauge their reactions to receiving text messages in an 'informal learning' context. According to this theory, collaborations between pairs of students could be most effective if the level of understanding between the paired students is slightly different, that is, one student has a slightly better understanding of the topics than the other student. Zone of proximal development theory was used in this study to help identify pairs of students whose level of understanding about the subject content was slightly different from one another, ensuring that the matched students level of understanding was not exactly the same or significantly different.

The study program involved assigning students to pairs (the pairing strategy is explained below), allocating each pair the task of reviewing a previous year's exam question related to a topic covered in the lectures. All participants were sent six text messages over the duration of four weeks (see appendix E). The messages were focused on encouraging students in each pair to work collaboratively on the task. Each pair was required to develop a written response to the past exam question over a four-week period. Students received different exam questions depending on their specialisations, that is, Early Year, Physical and Health Education or Primary (see Appendix C for examples of past exam questions used).

3.3.1.2.1 Pairing of the students

The students' self-efficacy scores were collected through the web-based questionnaire and exported to spreadsheet software. This rating was then used to pair students.

Students were grouped according to the following criteria:

- belonging to the same tutorial group (so that the students were familiar with their nominated study partner); and
- the rating difference for each member of the pair was no more than two.

This was done in accordance with Vygotsky's Zone of Proximal Development theory (Hogan & Tudge, 1999), which states that in order for both students to benefit from a peer-learning activity, the difference in competence between the students should not be significantly great. The competence between the pairs, however, should not be the same either, thus enabling the pair to take on a 'teacher/learner' type of role.

A simple macro was then used to identify scores with a maximum difference of two, which then matched pairs accordingly. Manual checking was done to ensure all the students were matched effectively. Some scores were not able to be matched automatically and had to be matched manually. Overall, 109 pairs of students were formed.

3.3.1.3 Data collection and analysis

All participants completed a customised online form that registered their mobile number and asked them to rate how confident they felt about understanding the content of the task using a self-efficacy rating scale. Self-efficacy is defined as a person's belief about their capabilities to produce designated levels of performance (Bandura, 1994). Those who rate their self-efficacy as high tend to be confident about their abilities and are more willing to take on challenges. People's self-efficacy can be strengthened through various activities and experiences including "seeing similar people succeed by sustained effort" (Bandura, 1994). The self-efficacy scale used comprised a 10-point Likert scale where 1 referred to low self-confidence and 10 referred to high self-confidence.

Table 5: below describes the various data collection instruments used and the rationale for using them.

Table 5: Data collected and analysis for the preliminary study

Research question	Data collected	Data analysis
How do students' react to receiving study-related text messages during out-of-class times?	SMSs	Qualitative analysis of SMS Qualitative analysis of peer collaboration feedback in the survey questions
What is the impact of using targeted, persuasive text messages on students' learning behaviours?	Final Survey Students completed the Self-efficacy rating scale twice (one pre-study and one post-study)	Qualitative analysis of comments in SMS Student comments about getting SMS during non-formal study times Examine pre- and post- self-efficacy rating scale to see if there is a difference ⁱ

At the end of the four-week study, students completed a paper-based survey, designed to seek more information regarding their perceptions in relation to the study, in particular, whether receiving the text messages and working with their nominated partner was effective.

The researcher attended the tutorial classes in the last week of the intervention to request that students complete the self-efficacy rating scale again and complete a survey. The survey consisted of nine questions related to students' perceptions of the intervention and asked if they thought that their participation helped improve their understanding of that particular concept of the subject. These responses were entered into spreadsheet software and analysed by categorising the data according to each of the questions (Survey is provided in Appendix D).

Participants were required to complete a post-activity self-efficacy rating. The pre- and post-activity self-efficacy rating scales were used to gauge the difference in the self-confidence ratings of students over the four-week period.

The timing of the text messages was designed to be sent both during the week and on weekends, between the hours of 8.00am and 10.00pm. This was done to examine the implications of contacting students about formal learning during their informal learning times and space. Most undergraduate students' formal learning times and space are generally between the normal university times, that is, between 9.00am and 5.00pm. Although a number of text messages were sent during the formal study time/space, by sending text messages outside of these times, the study aimed to gauge students' perceptions and reactions to being contacted during informal study times/space, thereby blending the boundaries between formal and informal study times. Two messages were sent in the first week of the intervention (Week 8) to inform participants of the identity of their assigned partner and the nature of the task. Three text messages were sent in the second week (Week 9) to remind participants to contact their partner and ask if they had started the task. The final text message was sent in the third week (Week 10) to remind students to bring their written response to the class tutorial. (Appendix E lists all the text messages sent to the participants.)

Once the pairs were identified, the first text message sent to each participant contained the mobile number and email address of their partner. Over the four-week period, the students were sent six text messages encouraging them to contact and collaborate with their nominated partner.

The students were not informed about how they should contact their nominated partners. They were free to choose any medium to contact each other through whatever means were convenient for collaboration (face-to-face meeting, mobile voice communication, text messaging, email, social media, etc.). Although it might be considered a limitation, it was decided that by not limiting students' means of communicating with their partners, it may be possible to encourage more collaboration as students would tend to use whatever means were convenient for them. The means used to collaborate was explored by questions in the final questionnaire.

Students were also able to send questions via text message to the researcher. These were forwarded to the researcher's email inbox. The researcher was able to reply to

these emails to initiate a text message through the text messaging gateway which was received on students' mobile phones. In total, the researcher received 76 text messages from the students.

As well as sending students the prompting text messages, students were encouraged to send one text message in Week 2 related to how they were progressing with the study. Over 200 text messages were received. Using spreadsheet software, the messages were classified into emerging themes such as: technology-related, confusion with the task, positive or negative responses.

3.3.1.4 Implications for the main study

The focus of the preliminary study was to identify both the technical and pedagogical features that could be refined to be further tested in a subsequent study. The key lessons learnt were that the technical features of the SMS gateway was reliable for bulk SMS and thus this was reused as is. However the findings from the pilot study suggested a more holistic approach to the use of mobile devices to support the development of personal study. As such a theoretical lens of self-regulated learning was used. These changes are explained below:

3.3.1.4.1 Technology required for sending and receiving bulk text messages.

Online SMS gateways are specialised online websites with appropriate software that allows users to send and receive bulk text messages conveniently and efficiently. The 'SMS Global'(www.msglobal.com, 2015) SMS gateway was selected as it provided easy to use interface to create templates for all the text message prompts and enabled scheduling of the text messages so that they could be sent automatically at pre-determined times. The local support office of SMS Global was also important in case any technical problem needed to be addressed urgently. Other features that made this site suitable for this research was the ability to configure it to forward all text messages from the students' to the researcher's mobile phone and email.

3.3.1.4.2 Students' reactions to receiving study-related text messages during out-of-class times.

Mobile phones are suitable devices to provide study related support. Participants were enthusiastic about utilising their mobile phones for study purposes.

The participants in the preliminary study also indicated that they were receptive to the study prompts that they received via text messages. They did not feel that the text messages were disruptive and appreciated the support provided as text messages.

Although the preliminary study encouraged students to collaborate in the learning activity by identifying suitable pairs, participants ended up not collaborating with their nominated partners. Feedback indicated that students do not prefer to do personal study with other students as the times and styles of study differed between students and therefore it was inconvenient to try to identify suitable times when both students were available to study.

Although collaborative learning is suitable to promote the development of various import skills, and is used in higher education, based on the findings of the preliminary study, it was deemed unsuitable for the mobile learning implementations used in the main study.

3.3.1.4.3 Impact of targeted, persuasive text messages on student's learning behaviours.

The participants reported, via the self-efficacy rating scale, that their confidence about attempting the lecture topics in the final exam had increased. They further reported, via student surveys, that their improved confidence was due to the support provided through this study.

It was difficult to gauge more in-depth understanding about the impact of the persuasive text messages on their learning behaviours just from the student surveys. It was deemed that face-to-face interviews should be used provide more detailed information about students learning behaviours and the impact of persuasive text messages, and therefore was included in the main study.

3.3.2 Ethical Considerations

This study was approved by the University of Wollongong Human Research Ethics Committee (UOW HREC approval number HE08/315, Appendix A). This included an initial approval for the preliminary study which was later modified with approval for the main study. Based on previous research (Dabbagh & Kitsantas, 2004; Jones & Edwards, 2009; Ley & Young, 2001) and the results of the preliminary study, this

type of study skills development program to promote the development of study skills can be beneficial for all students, especially those in their first year in higher education. With the consent of the subject coordinator, this independent study skills development program was integrated into the first six weeks of the Learning and Teaching with Technology subject (a first year subject in the Bachelor of Education degree at the University of Wollongong). All students were invited to participate by completing a consent form, completing the cognitive learning strategies sub-scales of the Motivational Strategies for Learning Questionnaire (MSLQ), receiving customised text message prompts, completing an end of study MSLQ as well as another student survey and participating in the face-to-face interviews.

During analysis, all the data were coded to protect the privacy of the participants, and data from the participants who volunteered were analysed. None of the participants' personal data were shared with any other organisations or individuals and were used exclusively for this study only.

All of these matters were explicitly explained to the students and provided in written form as part of the Participation Information Sheet (See Appendix B for the Participation Information Sheet and Consent Form given to the participants).

3.3.3 Main study

Informed by the findings of the preliminary study and the literature, the main study was designed to help first year university students develop their independent study skill by participating in a self-regulated learning program delivered using mobile phone text messaging technologies. Self-regulated learning was chosen as the focus for this program because it supported the development of independent study skills essential for university study. A study skills development program was designed and implemented with a cohort of first year Bachelor of Education students at the University of Wollongong. An evaluation of the program was carried out after participation to understand the effectiveness of the program on students self-regulated learning skills and their experiences with the program.

3.3.3.1 Participants

Previous research (Dabbagh & Kitsantas, 2004; Jones & Edwards, 2009; Nota, et al., 2004; van den Boom, et al., 2007) on the development of self-regulation skills for students, and the preliminary study of this research, indicate that effectively designed study skills development program that promote the development of generic study skills are very likely to have a positive impact on students' learning outcomes. The study skills development program designed as part of this research were offered to all students enrolled in the Autumn session 2011 cohort of the first year undergraduate subject: Learning and Teaching with Technology. Participation, however, was voluntary, in accordance with the requirements of the University of Wollongong's research ethics policy. All participants received customised study skill support via mobile text messaging over a six-week period.

Participants were also invited to complete a survey and were interviewed face-to-face to provide qualitative information about the intervention. Sixty-nine students volunteered to participate in this study and indicated this by signing a consent form (See Appendix B for a copy of the Participation Information Sheet and Consent Form). Eleven of these participants also volunteered to participate in the face-to-face interview.

3.3.3.2 Design and implementation of the study skills development program

The researcher consulted the subject coordinator and the content, assessment tasks and tutorial activities were discussed and ideas on how the use of text messages could be used were negotiated. So as to support students, it was decided that the first six weeks would be the most appropriate time to carry out the study as students are transitioning from their previous schooling to university. The study skills development program complemented the content of the subject by focusing on study skills to help students better understand the lecture content. This study aimed to develop students' self-regulated learning skills by engaging with them during their outside class times and spaces by sending a number of text messages at different times over a six-week period.

The content of the text messages was composed to focus on the cognitive learning strategies of the MSLQ framework, which includes rehearsal, elaboration, organisation, metacognition, time and space management, and self-effort (Pintrich, et al., 1991). (For the complete list of all text messages refer to Appendix J) The cognitive learning strategies were chosen for two reasons. First, it was decided that a study skills development program for first year students would be more effective if it focused on a coherent set of strategies rather than attempting to cover the full set of strategies included in the MSLQ. Second, consultation with the subject coordinator identified the cognitive learning strategies to be the most appropriate for students in this subject. This approach is possible because the MSLQ is comprised of 15 sub-scales that can be used together or singly, allowing a researcher to select on the scales most relevant to his/her study. The MSLQ Manual contains generic instructions to help students develop self-regulation learning skills. These instructions were adapted for text messaging, adhering to the 140 character limit and readability on mobile phones. The timing of the messages was determined using classification theories about formal and informal learning.

The study was introduced to the students during the lecture. The researcher then visited each of the tutorial classes to explain the study and answer students' questions. The information sheets and consent forms were distributed and participants were required to complete the online MSLQ and provide their names and mobile phone numbers.

The MSLQ (Pintrich, et al., 1991) was used to identify each student's competencies for each of the six cognitive learning strategies through an online version of the questionnaire that was developed and administered to the participants at the start of the study. This provided a baseline score indicating how each student's individual strengths and weaknesses related to the six cognitive learning strategies. Although all six learning strategies are important for successful university study, this study aimed to target the learning strategy in which students were least competent, and provide individualised, relevant support to help them improve their weakest self-regulated learning skill.

The calculated data from the online MSLQ, as well as students' names and mobile phone numbers were exported to Microsoft Excel spreadsheet software for manual analysis and categorisation. Students were categorised according to the self-regulated study skill that they needed most support in, for example, all students who scored the lowest in the MSLQ for 'rehearsal' were categorised as 'rehearsal students'.

Text message communication between one-to-one users or even one to a few users is very common and relatively easy to initiate and manage directly from mobile phones. Disseminating multiple text messages to a large cohort, however, requires a system that is capable of efficiently managing a large number of text messages. There are various online tools available for this, which are generally referred to as 'SMS gateways'. These allow users to send and receive text messages through an online website, and are a convenient option for managing large numbers of text messages. Most of the SMS gateways have been used successfully in mass marketing campaigns and disaster management applications (Shelke & Paranjpe, 2009; Vigar-Ellis, Ellis, & Barraclough, 2007).

The online SMS gateways allow users to create an account, purchase credit to send text messages and keep track of all text messages sent and received. A number of these SMS gateways also enable users to customise the text messages to indicate to the recipient who the sender is, forward all received text messages to an email account, create templates of text messages, import a contact list from various sources and schedule text messages to be sent automatically at different times.

For this study, the Global SMS gateway (www.msglobal.com, 2015) was selected as it provided reliability through a local support office, it was relatively easy to integrate the online tools with desktop email software packages, and it was able to schedule messages to be sent at different times. All the messages adapted from the MSLQ Manual for each of the self-regulated learning strategies was saved on the SMS Global gateway as templates. During the preliminary study, students indicated that they were not comfortable receiving text messages from unknown numbers, so the SMS gateway was configured to indicate that the messages were coming from the

researcher's mobile phone number, which was made known to the participants when they signed for this study.

The complete list of all participating students' names and mobile phone numbers were categorised according to the six self-regulated learning strategies and was imported from the Microsoft Excel spreadsheet and merged with the relevant text message template. The text messages were then scheduled to be sent automatically by the SMS Global gateway at determined days and times in accordance with the classification theories (see Appendix F for the complete list of all text messages). In subsequent weeks, these same text messages were sent again with the wording of the messages changed slightly, without changing the content of the message.

In the final week, students were requested to complete the online MSLQ again, as well as complete a survey which explored their experiences with receiving text message prompts. Students were also requested to participate in a face-to-face interview to provide further information about their experiences. Figure 1 gives a pictorial representation of this implementation.

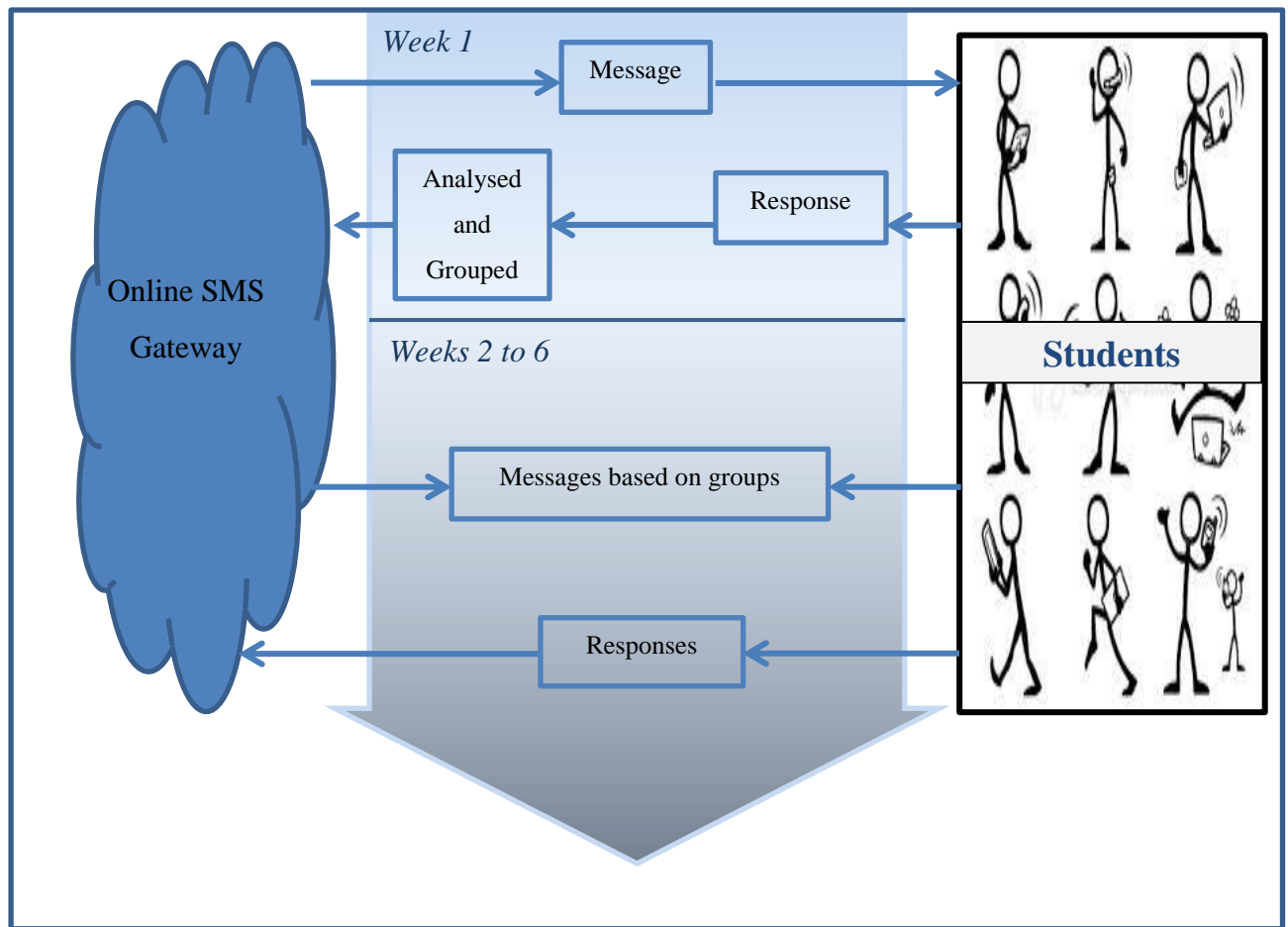


Figure 3: Implementation of the intervention

3.3.3.3 Data Collection

This study utilises multiple data collection methods which include the responses to the MSLQ, responses to a questionnaire about using text message for study, and a face-to-face interview. Table 1 summarises the data required in response to each research question and the techniques used to collect these data.

The quantitative data collected for this study include participants completing the initial MSLQ and a post activity MSLQ. Although the MSLQ is a self-reported system, studies have shown the predictive validity and reliability of these scores (Garcia, et al., 1993).

The qualitative data for this study include the questionnaire relating to the students' experiences participating in this mobile learning activity within their formal and informal learning spaces (see Appendix G for the questionnaire used) and data from face-to-face interviews. The interviews were structured using open-ended style questioning (see Appendix H for complete list of the interview questions) (Mertens, 2005) to allow students to provide rich descriptions of their experiences of receiving prompts to elicit responses to exercises designed to develop their learning strategies, as well as to elicit descriptions about their perceptions about receiving text messages to promote study at different times and within different contexts in their lives.

Table 6: Main study research questions and data collection

Research topic	Data gathering technique	Rationale
How can first year university students' be supported to develop their independent study skills using mobile phone technology?	Questionnaire (Appendix G) MSLQ scores before and after the study (Appendix I) Face-to-face interviews (Appendix H)	Questionnaire: identify student perceptions of the effect of receiving text messages to help them develop their study skill. MSLQ scores: comparisons between the pre-activity and post-activity scores. Interviews: explore students' perceptions of receiving text message- based prompts and their descriptions about engagement across formal and informal spaces.
How does the use of mobile phone technology impact first year university students' engagement in learning outside class?	Questionnaire (Appendix G) Face-to-face interviews (Appendix H)	Questionnaire: Students' perceptions of being contactable via text messages. Face-to-face interviews: the students' descriptions of the implications of getting text messages on their learning.

3.3.3.4 Data analysis

Three main sources of data were collected in this study. The table 7 below outlines the different types data that was collected.

Table 7: Number of participants and data collected

		Number of participants												
MSLQ		Pre-activity						Post-activity						
		Total	140						69					
		Study skills categories	Rehearsal	Elaboration	Organisation	Metacognition	Time and Study Space	Self-effort	Rehearsal	Elaboration	Organisation	Metacognition	Time and Study Space	Self-effort
			58	8	19	41	14	0	28	5	12	20	4	0
Questionnaire		Not applicable						69						
Interview		Not applicable						11						

Analysis of each is described as follows.

1. MSLQ: This is an online questionnaire (For the complete MSLQ used see Appendix I). When completed, the data were exported to the Microsoft Excel spreadsheet software. The spreadsheet software was used to create charts of the whole cohort's scores. A statistical t-test was also done to identify the significance between the pre-activity and post-activity MSLQ scores.

Pre-activity MSLQ scores: Apart from enabling the identification of each student's level of competence in relation to each of the study skills, this also provided a baseline score which showed where each student was placed in terms of his or her study skills.

Post-activity MSLQ scores: A quick indication about any changes in students' study skills was obtained by comparing the pre-activity MSLQ scores with the post-activity MSLQ scores.

2. Questionnaire: At the end of the six-week period, 69 students completed the online survey designed to gather more information from the participants regarding their experiences receiving the study-related text messages and how it impacted on their study behaviours. The questionnaire contained both

qualitative and quantitative data which initially were analysed separately. The data were then considered as a whole in order to discern more meaningful interpretations of students' experiences.

Data from the complete survey was exported to Microsoft Excel spreadsheet software for analysis. The complete survey was analysed according to each question and then further categorised as per the questions within each category of study skills, i.e. rehearsal, elaboration, metacognition, time and space, organisation, and self-effort. Quantitative and qualitative analyses were used with the survey data as follows:

Quantitative analysis: This involved creating summarised charts and graphs for each of the questions in the survey, providing high level understanding about students' responses to their experiences.

Qualitative analysis: This involved creating summaries for each of the answers that contained qualitative data. These summaries were provided by the researcher based on his interpretations of students' collective responses.

3. Interviews: During the face-to-face interviews, students were prompted to narrate their experience of this activity. The interviews were used to validate the data collected from the other forms, and gave the students an opportunity to add subjective perspectives of how they used the activity. Eleven students volunteered to participate in a face-to-face interview designed to seek rich information about students' higher education study experiences generally and their experiences of receiving the study-related text messages used in this study.

The interview format was free flowing and was recorded on the researcher's mobile phone. Interviews were transcribed by a professional transcriber, and then cross-checked by the researcher for accuracy. The answers to each question were interpreted by the researcher and themed summaries were provided next to each question. The interviewees' responses were then compiled onto a single table and further summaries were provided to capture the themes for each question from each interviewee.

All the data from the different sources were analysed by identifying recurring themes across the qualitative sections of the questionnaire and the face-to-face interviews, and then cross-checking this with the quantitative sections of the questionnaire and the MSLQ scores. For example when participants indicated, through the questionnaire, that they were prompted to study by the SMS, I then checked if there was corroborating in-depth descriptions provided in their face-to-face interviews to determine if this had a positive impact on their MSLQ scores.

To answer each of the research questions, the high-level summaries, as well as information from the literature review were correlated and a commentary was provided.

3.4 Quality of the study

The quality and credibility of this research was ensured by the use of multiple sources of data. For example, the survey instrument Motivated Strategies for Learning Questionnaire (MSLQ), which has been used in previous studies as a reliable instrument to identify and develop students' motivations and self-regulation study skills (Pintrich, 2004, Garcia, et al., 1993) was a key data source. This was accompanied by other quantitative data such as the closed items in the student questionnaire, which was administered at the end of the study. Qualitative data collected included the open ended questions of the student questionnaire and the face-to-face interview. This combination of qualitative and quantitative data was triangulated by first seeking similar themes from different sources. For example when participants indicated during the face-to-face interviews that they found the SMS prompts helpful, the data from the MSLQ survey was used to identify if they actually had been an improvement in their study skills. Furthermore, individual participant data was verified across different data sources to validity, for example checking participant's MSLQ scores with the quantitative and qualitative sections of the student questionnaire and the face-to-face interviews.

The MSLQ is a published tool that is widely used to measure college students self-regulated learning (Pintrich, 2004). The reliability and validity of the MSLQ has also been tested in previous studies (Garcia, et al., 1993). Analysis of the quantitative data

from the MSLQ was guided by the MSLQ guidelines (Pintrich, 2004). Statistical t-tests were conducted on the pre and post-activity scores to identify if the improvements in self-regulated learning were statistically significant. The closed questions in the student questionnaire were used to identify overall patterns and to get generalisations about each question.

The qualitative questions of the questionnaire and the face-to-face interview enabled the researcher to further explore the overall trends identified through the quantitative analysis. The qualitative data provided the researcher with rich descriptions about students' experiences participating in this study.

Summary

The use of both qualitative and quantitative data collection methods and analysis worked towards the intentions and purpose of this research, that is, to help understand the effectiveness of using mobile learning to help students develop self-regulated learning skills, essential for the success of university study. It also helped to understand students' perspectives of being contacted outside of class time for study-related topics.

In particular, the qualitative data collected via the pre-activity MSLQ provided a baseline of self-regulated learning skills and, by comparing that baseline with the post-activity MSLQ scores, it was possible to identify whether students' overall MSLQ scores had improved.

Students can develop and improve their self-regulation learning skills just by participating in the various teaching and learning strategies of university classes. In order to better understand the link between the targeted text messages and students' improved scores, the qualitative data derived from the end-of-study questionnaire and the face-to-face interviews provided rich descriptions of students' experiences and their perceptions of participating in this study. The case study approach has been effective in enabling the researcher to obtain rich descriptive and detailed data to help answer the research questions.

4 PROMOTING EFFECTIVE LEARNING USING MOBILE TECHNOLOGIES ACROSS FORMAL AND INFORMAL LEARNING SPACES

*Prepared for submission for review as: Anand, P., Agostinho, S., Bennett, S.,
Promoting effective collaboration using mobile technologies across formal and
informal learning spaces.*

4.1 Abstract

Research into the use of mobile phones for teaching and learning has increased in accordance with an increase in mobile phone use amongst student populations in higher education institutions. Previous research has also demonstrated that mobile phones are effective in enabling students to access learning resources conveniently, as well as promoting communication between students and teachers, suggesting the potential for using these devices to better engage learners. Although these studies discuss the educational potential of the communication and ubiquitous nature of these devices to promote interactivity, most mobile learning strategies do not promote interactivity between learners across formal and informal learning spaces.

This paper presents a study that investigated how mobile learning could support students' collaborative practices across formal and informal learning spaces and the impact on students' experiences in a university course. The study found that text messaging was effective in encouraging students to engage in learning activities, even though the participants were not keen to interact with each other.

4.2 Introduction

Mobile learning is defined as the practice of learning when the learner is mobile or not at his or her usual physical learning space, such as a classroom or home (Vavoula & McAndrew, 2005). Mobile devices are considered well-suited for educational applications because they provide (McManus, 2002):

- Convenience: Learners are able to use their mobile devices to participate in learning activities without having to be in a classroom or laboratory.
- Expediency: Learners are able to be mobile in the context that is currently relevant to their learning, such as participating in audio tours in museums.

- **Immediacy:** Opportunities to participate in learning activities may arise in different situations; mobile devices have the ability to enable learners to access learning activities as and when they need them.

More recently, mobile devices have provided new opportunities for people to interact using social media. Social networking using mobile phones provides opportunities for the user to simultaneously connect with multiple people, and sustain multiple conversations. A number of studies have explored this capability on mobile phones for educational applicability (Bleecker, 2006; Cochrane, 2006; Kekwaletswe, 2007; Smyth, 2011). Mobile devices provide a continuum of learning between formal and informal learning spaces.

Although there has been much advancement of mobile phone technologies, text messaging is still the primary form of communication for most people (ACMA, 2012-2013). The widespread nature of text messaging provides a number of opportunities for educators, such as:

- push notifications to students' mobile phones. Educators are able to 'disrupt students' by sending them learning-related prompts or content.
- effective communication even with limited or no internet connectivity. The 'traditional' cellular network is all that is required to send and receive text messages.
- a convenient way to share content. Various studies have shown the potential use of 'micro contents' to engage and prompt learners (Patten, Sanchez, & Tangney, 2006).

The study reported in this paper investigated the potential for text messaging to support collaborative peer learning between pairs of learners in a first year university course. Text messaging was used to facilitate collaboration amongst students in an on-campus class. Although a number of studies have used text messaging, this research differs in that it is used to promote learner-learner interaction by first matching students effectively and then enabling them to collaborate with each other using any means that is suitable for them. Even though students may be put into groups for collaborative learning, they may not necessarily participate proactively. Text

messaging was used to prompt students to connect with their nominated study partners and inform them of the location of appropriate resources.

The study reported in this paper is part of a broader study on mobile learning implemented at the University of Wollongong Australia.

4.3 Conceptual framework

This paper builds on the extensive work in relation to the importance of promoting learner-learner interactions to enhance effective learning (Boud, Cohen, & Sampson, 1999; Granger & Lippert, 1999; Hogan & Tudge, 1999; Topping, 2005; Zurita & Nussbaum, 2004) and enabling learners to continue learning across both formal and informal spaces (Bernstein, 1971; Chen, et al., 2007; Wali, Winters, & Oliver, 2008). The following sections outline the empirical research and theoretical concepts that inform this study.

4.3.1 Collaborative learning

Collaborative learning theories suggest that learning improves significantly when learners engage with each other while working through an activity. In formal settings, peer learning is often used to supplement tutorial activities by allowing students to experience more informal interactions. Peer learning can enhance learning through opportunities for joint construction of knowledge and skills. Specifically, research indicates that students are better able to retain what they have learned from their peers (Granger & Lippert, 1999).

Matching students appropriately is key to successful peer learning. Characteristics such as age, gender, motivation and context influence the way in which learners interact with each other, but the most important criteria is relative competence (Hogan & Tudge, 1999). In accordance with Vygotsky's concept of the 'zone of proximal development' (Hogan & Tudge, 1999), peer learning is most effective when there is a difference in competence between two individuals but that difference is not too great. If this condition is met then each member of the pair will receive benefits from the interaction (Topping, 2005).

Thus, an effective strategy is to match pairs of students for peer-learning activities, where a student who is more competent in a subject or topic would work with another student who is not as competent, with the aim of benefitting both students. Previous studies have shown that students are more willing to use peer learning as an adjunct to formal strategies if the outcomes are clearly articulated and the activities are well organised and structured (Granger & Lippert, 1999; Rubin & Hebert, 1998). Activities should be integrated with assessment tasks, with research showing that peer learning is less likely to succeed if students are not awarded marks for the extra effort required to collaborate (Boud, Cohen, & Sampson, 2001). It is also important that students feel confident that the teacher or expert support is available to them (Boud, et al., 2001). This support could take many forms, for example, journals, discussion forums, online ‘blogs’, email or even face-to-face discussions.

This study specifically investigated how mobile wireless devices—which provide ubiquitous, convenient communication—could be used to provide support for collaborative peer learning.

4.3.2 Classification

The application of mobile learning in this study was designed to extend across formal learning environments, where students attend classes during allocated times, usually on campus, and informal learning environments, which may be planned or spontaneous outside class time. Bernstein’s (1971) concept of classification provides a means to conceptualise “the degree of boundary maintenance between contexts” (p. 88). In education, this idea has been used to understand the strength of boundaries between different subject areas at school or university, and between learning inside and outside the classroom (Chen, et al., 2007). Bernstein’s classifications theories have been used in this study to understand the boundaries that exist between students when they are engaged in inside classroom learning activities as ‘formal’ learning and the time spent by students on ‘informal’ learning outside class. Within this formal and informal learning boundaries there also often exists boundaries between the intent of the learning activities and the structure, in form of physical spaces, domain. (These concepts are explained in more detail in Chapter 2 of the thesis).

For example, formal learning spaces include timetabled classes and lectures, timetabled non-class activities and study schedules that students may create for themselves. Informal learning spaces include all other spaces where learning can occur but are not scheduled and/or timetabled. These can include unplanned meetings with other students on or off campus and discussions that may revolve around their in-class learning requirements. According to Mejia (Mejia, 2007), informal interactions “do not have a predefined schedule or place of encounter, are spontaneous, not planned and brief, and where the topic of discussion can change during the course of the interaction.” It is possible to guide these informal interactions so that they become productive by providing opportunities for these interactions to happen and by prompting the participants to communicate on certain topics.

Although most of these formal and especially informal interactions occur face-to-face, technology tools such as mobile phones and social media facilitate these interactions. Mobile phones also make it easier for students to cross these informal and formal boundaries. For example, students may use informal social networking sites to collaborate on formal university-related topics or use mobile phones to organise social events during formal lectures. In the case of mobile phones, students can be virtually “transported” (Hjorth, 2005) from informal learning spaces to formal learning spaces.

Previous research provides some evidence of how mobile phones can weaken the boundaries between inside classroom and outside classroom activities. When using their mobile phones, students can access learning resources while in a classroom environment. They can continue to research the same topic outside class time and may also collaborate with other students using their mobile devices, both inside and outside their classes (Wali, et al., 2008). Students can effectively form a virtual learning space when they collaborate on learning activities using information technology tools while being geographically dispersed (Yang, 2006). Similarly, physical boundaries are weakened to bring students together in a virtual learning space, including with the use of SMS (Hjorth, 2005; Yang, 2006). By blurring these boundaries, it may be possible to integrate learning activities into students’ lives regardless of their context, and this may have a positive effect on improving learning outcomes. Some individuals, however, may prefer to maintain a strong separation

between formal education and other aspects of their lives. This study seeks to understand how the participants experienced the weakening of boundaries across formal and informal learning.

4.4 Methodology

A case study methodology (Yin, 1993) was employed to investigate how mobile devices can be used to promote peer learning within a first year pre-service teacher university subject. The subject coordinator of a first year Bachelor of Education introductory educational technology subject was consulted and, together with the subject coordinator, a study program was developed and implemented whereby participants were paired and sent a number of text messages over a four-week period with the aim of helping them study a topic in the course subject. A case study was deemed a suitable methodology as it enabled the researcher to observe participants in a naturalistic setting and provide a rich understanding about the way in which students engaged in the mobile learning activity.

This preliminary study was conducted to inform the design, implementation and evaluation of the main study described in the chapter 3 and chapter 5. The goals of this preliminary study were to:

1. implement and test the technology required to send and receive bulk text messages.
2. develop a preliminary understanding of students' reactions to receiving study-related text messages during out-of-class times.
3. develop an initial understanding of the impact of using targeted, persuasive text messages on students' learning behaviours.

4.4.1 Participants

All students enrolled in the subject were invited to participate, however their participation was voluntary. Of a total enrolment of approximately 350 students, 224 volunteered to participate. Participants were also informed that they were able to withdraw their participation at any time without any negative consequences. Eight students withdrew from the study about midway, leaving 216 participants in total.

4.4.2 Design and implementation of mobile learning collaborative activity

The study program was implemented from Week 8 to Week 11 within the 13-week semester of the subject. The purpose of the study program was to test the implications of applying Vygotsky's Zone of Proximal Development theory (Hogan & Tudge, 1999) to match students for peer-learning activities based on their self-efficacy scores, as well as to gauge their reactions to receiving text messages in an 'informal learning' time and space.

Both qualitative and quantitative data was collected to answer the research questions for this research. The self-efficacy rating by the participants before and after the activity provided an indication about improvements in their confidence about the topics covered in the lectures. Text messages from the participants to the researcher was also analysed to seek more information about their reactions during participation and an end-of-study survey was used to gauge participants' feedback about what they felt about the mobile learning activity. Table 1 indicates how the data collected was used to inform the research questions.

Table 8: Data collected to inform research questions

Research question	Data collected	Data analysis
How do students' react to receiving study-related text messages during out-of-class times?	SMSs Final Survey Self-efficacy rating scale	Qualitative analysis of SMS Qualitative analysis of peer collaboration feedback in the survey questions
What is the impact of using targeted, persuasive text messages on students' learning behaviours?		Qualitative analysis of comments in SMS Student comments about getting SMS during non-formal study times Examine pre- and post- self-efficacy rating scale to see if there is a difference

All the messages sent to the students as well as messages sent by the students were downloaded and analysed manually. The final survey contained both quantitative and qualitative components. The results of this survey was analysed using spreadsheet software as well as manually. All the qualitative data form the final survey and the

SMSs were analysed by looking for recurring themes and a summary was provided for each of the identified theme. This was then cross-checked against the quantitative data from the self-efficacy rating scale to see if there was a trend. The self-efficacy rating scale contained only quantitative data and was analysed using spreadsheet software.

The study program involved assigning students to pairs (pairing strategy is explained below), allocating each pair the task of reviewing a previous year's exam question related to a topic covered in the lectures. All participants were sent six text messages over the duration of four weeks. The messages were focused on encouraging students in each pair to work collaboratively on the task. Each pair was required to develop a written response to the past exam question over a four-week period. Students received different exam questions depending on their specialisations, that is, Early Year, Physical and Health Education or Primary (see Appendix C for examples of past year exam questions).

The pairing of students was conducted as follows: All participants completed a customised online form that registered their mobile number and asked them to rate how confident they felt about understanding the content of the task using a self-efficacy rating scale. Self-efficacy is defined as a person's belief about their capabilities to produce designated levels of performance (Bandura, 1994). Those who rate their self-efficacy as high tend to be confident about their abilities and are more willing to take on challenges. People's self-efficacy can be strengthened through various activities and experiences including "seeing similar people succeed by sustained effort" (Bandura, 1994). The self-efficacy scale used comprised a 10-point Likert scale where 1 referred to low self-confidence and 10 referred to high self-confidence.

This rating was then used to pair students, according to the following criteria:

- belonging to the same tutorial group (so that the students were familiar with their nominated study partner); and
- rating difference for each member of the pair was no more than two.

This was done in accordance with Vygotsky's Zone of Proximal Development theory (Hogan & Tudge, 1999), which states that in order for both students to benefit from a peer-learning activity, the difference in competence between the students should not be significantly great. The competence between the pairs, however, should not be the same either, thus enabling the pair to take on a 'teacher/learner' type of role.

4.4.2.1 Pairing of the students

The pairing of the students was also in line with the classification theories that attempted to break the barriers associated with students choosing their own study partners based on who they knew.

The students' self-efficacy scores were collected through the web-based questionnaire and exported to a spreadsheet software. A simple macro was then used to identify scores with a maximum difference of two, which then matched pairs accordingly. Manual checking was done to ensure all the students were matched effectively. Some scores were not able to be matched automatically and had to be matched manually. Overall, 109 pairs of students were formed.

Once the pairs were identified, the first text message sent to each participant contained the mobile number and email address of their partner. Over the four-week period, the students were sent six text messages encouraging them to contact and collaborate with their nominated partner (see appendix E for a full list of all text messages sent). The timing of the text messages was designed to be sent both during the week and on weekends, between the hours of 8.00am and 10.00pm. This was done to examine the implications of contacting students about formal learning during their informal learning times and space. Most undergraduate students' formal learning times and space are generally between the normal university times, that is, between 9.00am to 5.00pm. Although a number of text messages were sent during the formal study time/space, by sending text messages outside of these times, the study aimed to gauge students' perceptions and reactions to being contacted during informal study times/space, thereby blending the boundaries between formal and informal study times (Bernstein, 1971). Two messages were sent in the first week of the intervention (Week 8) to inform participants of the identity of their assigned partner and the nature of the task. Three text messages were sent in the second week (Week 9) to remind

participants to contact their partner and ask if they had started the task. The final text message was sent in the third week (Week 10) to remind students to bring their written response to the class tutorial. Appendix E outlines all the text messages sent to the participants.

The students were not informed about how they should contact their nominated partners. They were free to choose any medium to contact each other and whatever means were convenient for collaboration (face-to-face meeting, mobile voice communication, text messaging, email, social media, etc.). Although it might be considered a limitation, it was decided that by not limiting students' means of communicating with their partners, it may be possible to encourage more collaboration as students would tend to use whatever means were convenient for them. The means used to collaborate was explored by questions in the final questionnaire.

Students were also able to send questions via text message to the researcher. These were forwarded to the researcher's email inbox. The researcher was able to reply to these emails to initiate a text message through the text messaging gateway which was received on students' mobile phones. In total, the researcher received 76 text messages from the students.

The researcher attended the tutorial classes in the last week of the intervention to request that students complete the self-efficacy rating scale again and complete a survey. The survey consisted of nine questions related to students' perception of the intervention and asked if they thought that their participation helped improve their understanding of that particular concept of the subject.

As well as sending students the prompting text messages, students were prompted to send one text message in Week 2 related to how they were progressing with the study. Over 200 text messages were received. Using spreadsheet software, these messages were classified into emerging themes such as: technology-related, confusion with the task, positive or negative responses.

At the end of the four-week study, students completed a paper-based survey which was designed to seek more information regarding their perceptions in relation to the study, in particular, if receiving the text messages and working with their nominated partner was effective (see appendix D for a full the survey questions used). These responses were entered into spreadsheet software and analysed by categorising the data according to each of the questions.

Some typical questions included the following:

- Do you think getting the text messages helped you to revise your assigned topic?
- To what extent did working with your nominated partner help you to answer the question?
- Do you think that receiving SMS for study purposes has been disruptive to your normal work/life/leisure activities?

All participants were required to complete a post-activity self-efficacy rating. The pre- and post-activity self-efficacy rating scales were used to gauge the difference in the self-confidence ratings of students over the four-week period.

4.5 Results

All 224 participants completed the self-efficacy questionnaire and opted to receive the text messages. The start of study self-efficacy scores indicated a mean of 4.3 with a standard deviation of 1.8. The maximum score reported by participants at the beginning of the study was 8 and the minimum score was 1. This indicates that although some participants were reasonably comfortable with the topics, a majority were not. Most of the participants scored their self-efficacy as 5 (the median score) or below.

Figure 4 represents the comparisons of participants' before and after self-efficacy rating.

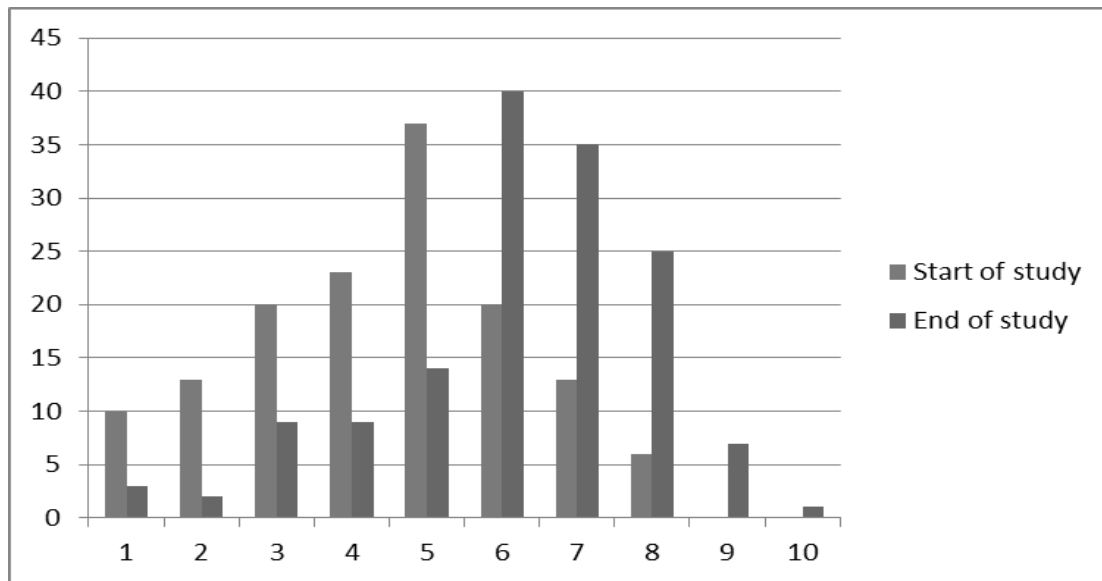


Figure 4: Comparison of participants' before and after self-efficacy ratings

At the end of the study all the participants were again invited to provide their self-efficacy rating. Although self-efficacy is not an absolute measure of ability it does indicate student's confidence about their own ability. Figure 1 indicates shows that there was noticeable movement in overall participants' rating towards the upper end of the scale, suggesting that most participants managed to improve their confidence with the topic. Eight participants opted out of the study after first signing up and 82 participants did not complete the end of study requirement of providing their post-study self-efficacy scores. The total number of participants who completed the study was 145 ($n=145$) and the mean self-efficacy score was 6.2 with a standard deviation of 1.8.

In the second week of the activity, participants were requested to text message a short reflection about how they were progressing with the activity. Most replied to these prompts within a day of receiving them. Over 85% ($n=123$) indicated that they were generally happy to receive the prompting text messages and the revision questions. One participant commented, "I am going ok with the questions" (student's text message). Although approximately 40% ($n= 58$) indicated that they had yet to contact their nominated partners, they commented that they intended to contact them soon to work through the revision questions. For example, "Haven't really had a

chance with all the tasks due at present! I know who my partner is so we will get around to discussing it. I have the task at hand so” (student’s text message).

Overall, over 90% (n= 131) of all participants provided positive feedback during the course of the activity, indicating that they were able to engage with the activity and appreciated the support provided via text messaging, as suggested by “The revision was clear and not too difficult. We discussed the questions and completed one of the topics. Was good to be able to communicate with a partner” (student’s text message).

In the survey administered at the end of the study program, 46% (n=66) of participants indicated that they had found the study helpful and were confident that the activities improved their understanding of the topic. They further stated that they found the reminders particularly useful closer to exam times. The participants found that working with someone else was valuable, as was being connected to the researcher and having the opportunity to ask questions via text messages at any time. Some indicative comments include, “Two heads is better than one”, “You gained another perspective/insight” (student comment). They also commented that the text messages were effective in making them think about studying. For example, “I believe this study helped me to be a bit more prepared for the exam. Helped me to see the sort of questions which would be asked in the exam” (student comment).

Some participants (9%) (n= 13) were unsure about whether they really benefitted from the activity. These participants did not provide any comment about this rating in the questionnaire.

Approximately 45% of participants indicated that they did not find the activity helpful. However, most of these (65 students) stated that they were unable to work on the activity due to time constraints. This activity was not incorporated into the students’ assessment tasks, and therefore they tended to pay more attention to the activities that contributed towards their overall grades. Additionally, some participants did not receive cooperation from their nominated partners for various reasons, and thus they were unable to collaborate.

Of all the participants who collaborated with their nominated partner (n=87), over 74% contacted their partners after receiving reminder text message. In the survey conducted at the end of the study, over 90% of the participants indicated that they initially communicated with their nominated partners via text messages, but that a number of subsequent conversations were conducted via email and face-to-face. For example, one participant commented that, “saw my partner in class and we communicated that way” (student comment). A number of other similar comments were made by participants about communicating via email and face-to-face.

Approximately 47% of participants indicated that the text messages helped them revise the topic. Generally, these participants commented that they appreciated the opportunity to work with another student. The participants also felt that they needed to be prepared for the discussions as they were ‘accountable’ to their partner. They found the text messages to be an effective prompt for study. Fifty-three percent of the participants who completed the survey indicated that the text messages were not useful in helping them revise the questions. Generally, they indicated that time constraints were the biggest restriction to their participation, as is expressed by “I think this would be so effective if assessed because it wasn’t assessable I didn’t get around to it” (student comment). Once again, participants tended to focus more on the tasks that had marks allocated to them. Revision, especially as part of someone else’s research study, was not considered important enough. Although these participants indicated that they did not find the text messages helpful in relation to their revision of the questions, ten participants commented that the text messages did generally serve to remind them to study.

Over 85% of the participants indicated that they did not find the text messages disruptive to their non-study activities, even though three text messages were sent when the participants were not attending formal study sessions. In the surveys, participants commented that these non-study activities included socialising, working and sleeping. Seven text messages were received from the participants during these ‘informal’ time frames. Some of the general comments from these participants suggested that text messaging was normal and that “it happens all the time”. Fewer than 15% of the participants indicated that they found the text messages disruptive.

These participants were particularly critical about receiving text messages late at night, although most found the text messages just annoying, and were able to ignore them.

Just under 34% of participants did not complete the end of study components. Although there was no end of study data for these participants, their beginning of study self-efficacy ratings was used to try to explain why they did not opt to complete the end of study components.

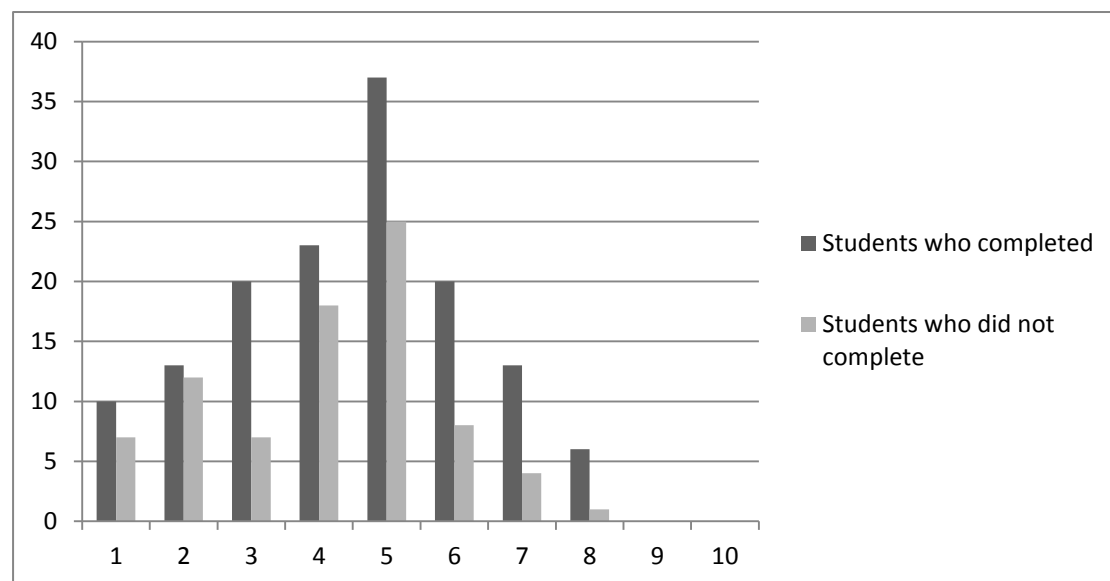


Figure 5: Comparison of self-efficacy between participants who completed and students who did not complete the study

Of the participants who did not complete the study, 84% rated their self-efficacy as below the middle score on the rating scale, however only 73% of participants who completed the end of study rating indicated at the start of the study that they were below the middle score on the rating scale.

4.6 Discussion

The aim of this study was to investigate how learning could be supported via mobile learning, in particular the study enabled pairs of students of collaborate on revising a topic for the final examination. The study was also used to inform the technical design and implementation of the main study. This study used participants' self-efficacy ratings to identify pairs of students based on Vygotsky's Zone of Proximal

Development (Hogan & Tudge, 1999), which suggests peer learning is most effective for both students if the difference in understanding between them is not significant. The selected pairs were provided with revision questions and encouraged to work on them together. Participants were sent a number of text messages designed to encourage them to start thinking about the revision topic, ideally in pairs, regardless of their location. These messages were sent at different times of the day, including evenings and weekends. Most participants reported that the text messages did prompt them to think about studying, even if they did not collaborate with their nominated partner. Although a number of participants appreciated the opportunity to work with another student, they were unable to commit to this activity due to higher priority tasks such as completing assignments. Participants generally did not feel that the text messages were invasive. The text messages were able to encourage the participants to shift their attention from whatever they were doing outside their class time, to study-related matters. Even if this change of focus was only brief, it did stimulate the students to revise the assigned topics.

Previous studies have argued that, to be most effective, peer-learning activities must be incorporated into existing assessment tasks (Boud, et al., 1999). Even though this study did not incorporate this activity into assessment tasks and no marks were awarded for participating in this activity, students who did collaborate with their nominated partner commented on the positive influence it had on their understanding of the topic. The activity may have been more effective if it was included in the assessment component as students tended to prioritise their assignments and spend more time on tasks that were assessable.

Although the study was not designed to seek feedback from the tutors, informal feedback from some tutors suggested that they had noticed that students who did attempt to participate in the study were in fact more confident about discussing the revision questions in class.

4.6.1 Limitations of the study

It is important to acknowledge the limitations of this study. All participants were volunteers and were able to withdraw at any time. As a result, it is likely that the participant group comprised the more engaged students from the cohort, who may not be representative of the full cohort. In addition, the measures used were self-reports, and self-efficacy is a perception of their ability not a measure of their ability, future research should include measures of student results.

The design of the data collection instruments did not provide enough opportunities to seek in-depth feedback from the participants about why they did or did not engage in the collaborative learning activities. This led to the inclusion of open ended face-to-face interviews for the mains study.

4.6.2 Implications for the main study

The focus of the preliminary study was to identify both the technical and pedagogical features that could be refined to be further tested in a subsequent study. The key lessons learnt were that the technical features of the SMS gateway was reliable for bulk SMS and thus this was reused as is. However the findings from the pilot study suggested a more holistic approach to the use of mobile devices to support the development of personal study. As such a theoretical lens of self-regulated learning was used. These changes are explained below:

4.6.2.1 Technology required for sending and receiving bulk text messages

Sending and receiving bulk individual text messages is convenient and a relatively simple process, often initiated from the users mobile phones. Sending and receiving bulk text messages on the other requires careful consideration due to convenience and costs. A number of online technologies exists that enable convenient and cost effective management of bulk text messages, these technologies are often referred to as 'SMS Gateways'. For this study, and the main study, the 'SMS Global' gateway was selected as it provided a cost effective sending of text messages, as well as a easy to use interface to configure templates with the text messages and scheduling for the text messages to be sent automatically as determined times. The SMS Global also had

a local support office which was important in case any problems needed to be resolved urgently.

The SMS Global gateway was configured to send text messages indicating that the messages were from the researcher and all the text messages from the participants to the researcher was automatically archived on the SMS Global website and a copy sent to the researcher's email and mobile phone.

4.6.2.2 Participants' reactions to receiving study-related text messages during out-of-class times.

The participants did not feel that the text messages were intruding on their personal time. Although the text messages were sent at times when the participants were involved in various, often non-study related activities, they appreciated the help they received via the text messages as a prompt to get them to start to engage in studying and revising for their final examination. Mobile phones are therefore considered to be suitable, non-invading technology to use to provide appropriate study support to students during their out-of-class times.

The text messages that were sent in this study encouraged the participants to collaborate with another identifies student while revising, participants did not end up collaborating with their nominated partner because in some cases it was inconvenient to find a suitable time for both participants, but also because they did not feel it to be important. Although the text messages encouraged individual participants to engage in study and revision, it was not possible to actively engage participants to collaborate.

Although collaborative learning is important for acquisition of various important real life skills and is valued in higher education (Dillenbourg, 1999), it was deemed not suitable for the mobile learning activity implemented in the main study.

4.6.2.3 Impact of targeted, persuasive text messages on participants' learning behaviours.

The pre- and post-activity self-efficacy rating scale by the participants indicated that the participants' confidence about the lecture topics had improved. The questions in

the student survey indicated that the participants felt that the improvement was due to the text message prompts. Self-efficacy is a self-reported confidence about students' abilities and may not necessarily reflect the actual abilities of students. Although these findings are encouraging, due to the preliminary nature of this study, it was not possible to seek further in-depth feedback from the participants about how the text messages helped them improve their confidence.

For the main study, face-to-face interview was added as another form of data collection to seek more in-depth descriptions from participants about how the text messages impacted on their learning behaviours. (Findings from the main study that explored the impact of SMS messages on students learning is reported in more detail in Chapters 6 and 7)

4.7 Conclusion

This paper has considered the effectiveness of using text messaging to support learner-learner interactions across formal and informal contexts. The text messages promoted student interactions via email, text messages, other social networking sites, as well as face-to-face. The results indicate that participants reacted positively to the text messages however did not feel that collaborating with their nominated partners was useful. Despite this the participants were able to improve their self-confidence in the subject.

Although a number of more advanced technologies exist to provide support to students during their out-of-class times, this study has demonstrated that text messaging can be highly engaging and effective.

4.8 References

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5 DESIGN OF A PROGRAM TO SUPPORT STUDENTS TO DEVELOP INDEPENDENT STUDY SKILLS THROUGH THE USE OF MOBILE TEXT MESSAGING TECHNOLOGY

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5.1 Abstract

A number of large-scale studies (Duckworth, et al., 2009; Kift & Field, 2009; Skene, et al., 2006) in Australia and internationally have identified that most first year university students are inadequately prepared to cope with the demands of university study. A number of these studies have also stated that the first year in the higher education experience is a critical factor for the successful completion of university courses. Recent studies (Bamforth, 2010; Dabbagh & Kitsantas, 2004; Jones & Edwards, 2009; Wilson, 2009) have identified that first year university students need to develop important independent study skills such as goal setting, help-seeking abilities, self-monitoring, self-evaluation, task strategies and time management.

At the same time, higher education institutions are experiencing a growth in the use of wireless mobile devices amongst their student populations. Research in the use of wireless mobile devices for education and learning has also increased. Studies (Bollen, et al., 2004; Dyson, et al., 2009; Markett, et al., 2006) have demonstrated that mobile wireless devices are effective in enabling students to connect conveniently to universities' learning resources and management systems. In addition, such devices enable students and teachers to communicate promptly via text messages. This suggests the possibility of institutions utilising mobile devices to better engage learners and extend support services to them. Other studies (Gurtner, et al., 2011; Kovachev, et al., 2011; Laru & Jarvela, 2008; Shih, et al., 2005) have also demonstrated an increased interest in the use of mobile learning to help students develop self-regulated learning skills.

This paper describes a theoretically-based design of a mobile learning activity to promote the development of self-regulated study skills among students in their first

year in higher education studies. (More information about the theories used to guide the development of this learning activity is provided on page 94) Targeted text message prompts were used to engage students in their outside class study times. The observations presented in this paper will be useful for other educators interested in using mobile technologies to effectively promote the development of independent study skills.

5.2 Introduction

Students entering the first year in higher education face a number of challenges due to the different educational environment in which they find themselves compared to their previous experience in schools and technical and vocational institutions (Jones & Edwards, 2009). These students generally experience an inability to cope with the demands of independent and self-directed learning (Dabbagh & Kitsantas, 2004). The first year university experience is an important factor in determining a student's success in subsequent years (Bamforth, 2010; Kift & Field, 2009; Wilson, 2009). Universities are rightly recognising the importance of effective and deliberate support and curriculum design to ensure first year success, thereby reducing attrition rates.

A coherent, coordinated approach must be adopted involving curriculum, support, formal and informal learning situations, as well as integration into the university social and co-curricular activities to promote student engagement (Kift & Field, 2009; Krause, 2009; Wilson, 2009) and deep learning outcomes. A number of research studies have identified various independent study skills that promote student engagement with the teaching and learning activities of universities. Even though there is some disagreement about what actually constitutes these independent study skills, there is a consensus that self-regulation skills are an important part of this independent skill set which students must develop in their first year at university (Dabbagh & Kitsantas, 2004; Kift & Field, 2009; Wilson, 2009).

Previous studies have identified that although there have been numerous attempts by various higher education institutions to promote engagement and acquisition of independent skills, there has been a lack of emphasis on the development of self-regulation and self-management skills even though these skills have been identified as significant (Taylor, 2008; Kift & Field, 2009).

Highly developed self-regulated learning skills are linked to better academic performance and lower attrition rates among first year students (Berger & Braxton, 1998; Nota, et al., 2004). In order to develop these skills, students need to be motivated to actively participate in the learning activities and university life in general (Jones & Edwards, 2009; Torrano & Torres, 2004). Research suggests that students who self-regulate their learning are competent in planning, controlling and managing time (Torrano & Torres, 2004). Further, Torrano & Torres (2004) point out that with effective training it is possible to develop these self-regulatory behaviours among students through “direct teaching, modelling, guided and independent practice, feedback, self-observation and social support” (Torrano & Torres, 2004, p. 17).

At the same time, an increasing number of students are using mobile phones, in particular the SMS feature of their phones (ACMA, 2012-2013). A number of research studies have demonstrated that it is possible to successfully include mobile devices in the delivery of teaching and learning activities (Berry & Hamilton, 2006; Kervin, 2005; Swan, Hooft, Kratcoski, & Unger, 2005). There are opportunities for using mobile devices due to their convenience and ubiquitous nature (Colella, Borovoy, & Resnick, 1998), such as being able to communicate with students promptly, enabling them to access learning resources at a convenient time. For example, a study that examined the use of mobile devices in an elementary class in America found that students’ motivation, their engagement and the overall support for their learning activities increased because they felt more engaged due to the personal nature of the mobile devices (Swan, et al., 2005). Students did not have to share the devices with other students unlike laboratory computers. Similar findings have been reported in Australia by Kervin (2005), who used mobile phones within a class of primary school students to facilitate better, more immediate communication between students and their parents. Other studies (Mejia, Morán, & Favela, 2007; Osawa et al., 2005; Yee & Park, 2005) have also reported increased motivation and engagement in learning activities using mobile devices.

The exponential increase in the use of mobile phones equipped with advanced technological features makes it convenient to use students’ mobile phones for learning. Whilst a number of authors assert that mobile learning is the future for

effective learning and student engagement, it is important to ensure any mobile learning initiatives are well thought through and embedded in tried and tested learning theories, and not just for the novelty of the technology (Sharples, Taylor, & Vavoula, 2005; Wali, et al., 2008). Although some recent research studies have started to implement mobile learning environments based on sound theoretical concepts, most still are struggling to connect theoretical learning concepts with relevant affordances of mobile devices. For example, in a study by Goh et al (2012) where persuasive text messages were used to help students develop their self-regulation study skills, the text messages were not customised to reflect students' individual self-regulation capacities. In another study (Sha, Looi, Chen, & Zhang, 2012) mobile phones were also used to help students develop self-regulation skills, the instructions to develop and measure those skills was lacking in theoretical grounding. This study is different as it attempts to send text messages tailored to each student's individual cognitive learning strategy of the self-regulation learning framework (Pintrich, 2004). It uses tried and tested models to develop and measure students' self-regulation capacities.

Text messages have been proven to be more effective in gaining student attention than emails (Stone, Biggs, & Smith, 2002). A number of studies have utilised the text messaging features of mobile phones to support teaching and learning activities. G. Jones et al (Jones & Edwards, 2009) used text messages together with traditional teaching and learning strategies such as lectures, tutorials and online learning environments to support students in their first year in higher education. Text messages were used to send guidance from tutors to their students, and students used it to pose questions to their tutors. They also used text messages to notify students of resources on the virtual learning environment. Students' questions through text messages were used to inform the structure of further face-to-face classes. It was concluded that students valued the text messages they received, that they provided a worthwhile contribution to their learning and made them feel that the teaching staff cared about them.

A fundamental premise of mobile learning is that mobile technology offers 'anytime, anywhere' learning, breaking down traditional boundaries between the classroom and everyday life (Wali, et al., 2008). Mobile phones have already been used to

demonstrate that it is possible to weaken the boundaries that exist between formal and informal learning environments. Some previous studies have used mobile phones to weaken the physical barriers between inside classroom and outside classroom activities (Wali, et al., 2008), thereby bringing students together in a virtual learning space where they can work collaboratively. Mobile phones have a similar effect when text messages are used to collaborate on formal learning topics, which effectively ‘transports’ students from their usual thought processes to a virtual environment, connected by their mobiles (Yang, 2006). By blurring these boundaries, it is possible to integrate learning activities into students’ lives regardless of their context, and this has a positive effect on learning outcomes (Gikas & Grant, 2013).

The preliminary study described in chapter four of this thesis was also used to inform the design of this study. The preliminary study was used to identify and test the SMS Global (www.smsglobal.com, 2015) online gateway to send and receive bulk text messages. Although collaborative learning plays important role in higher education, through the findings of the preliminary study it was deemed appropriate to use independent learning to promote the development of self-regulated learning skills.

This paper describes a theoretically-based design of a mobile learning environment to help first year university students develop effective study skills by using text message prompts. The implementation of this learning environment is based on the principles of self-regulated learning. This research also studies the effect of blurring boundaries between formal and informal learning contexts. The following sections describe the theoretical framework using self-regulated learning and classification theories, the teaching and learning context for the research, the pedagogical and technical design of the learning environment, as well as a discussion about some of the constraints and challenges of this research and opportunities for further research.

5.3 Conceptual framework

Two theoretical constructs were used to guide the design of the research and the learning intervention. Self-regulated learning theories (Pintrich, et al., 1991) were used to identify students’ self-regulation study skills capabilities. This information was then used to help them develop appropriate self-regulation study skills by suggesting appropriate strategies they should use. Classification theories were used to

conceptualise the difference between formal and informal learning environments. Text messaging was used to interrupt students in their formal and informal learning environments to promote appropriate learning strategies.

5.3.1 Self-regulated learning

Learning strategies are the methods and processes that students use to learn. For example, some students employ memorising techniques while others may develop skills associated with sitting for examinations. There is a growing recognition that effective learning strategies are important to promote greater independence in student-centred learning environments (Stage, Muller, Kinzie, & Simmons, 1998; Zimmerman, Bandura, & Martinez-Pons, 1992). As more and more universities move towards student-centred learning in their teaching and learning strategies, students must develop skills to manage their own learning effectively. Self-regulation study skills have been demonstrated to be important in relation to independent, student-centred learning (Zimmerman, et al., 1992). They “include the ability to concentrate, become involved in group activities, restrain disruptive and impulsive behaviour and work autonomously” (Duckworth, et al., 2009). Studies have also shown that there is a strong positive correlation between students’ self-regulated learning skills and their academic grades, indicating that those who demonstrate effective self-regulation abilities tend to also achieve better grades (Ley & Young, 2001; van den Boom, et al., 2007). However, self-regulation learning skills have been identified as missing from the various attempts to promote the development of generic study skills (Bamforth, 2010; Taylor, 2008).

Self-regulation is a broad concept that includes a number of skills and abilities. Although some students would develop these skills as part of their university study process, most need help (Skene, et al., 2006). Research shows that it is possible to explicitly embed strategies to develop self-regulation skills into instruction (Corno & Randi, 1999; Nisbet, 1991; Schunk & Zimmerman, 1998; van den Boom, et al., 2007). For example, the research conducted by van den Boom et al (2007) used reflections and suggestive feedback to develop students’ self-regulation skills. This study used the cognitive learning strategies of the Motivational Strategies for Learning Questionnaire (MSLQ), developed by Pintrich et al (1991) to identify the

changes in students' self-regulation skills as well as the implications of their interventions on student learning (van den Boom, et al., 2007). (For a complete description of the MSLQ please refer to page 97)

Chang (2005) used the MSLQ in a web-based learning environment to help students develop self-regulation study skills. As part of this study, the questionnaire was administered to students who were invited to reflect on the areas of self-regulated learning skills that they needed to improve upon while they participated in various online learning activities. These activities were not explicitly designed to improve the self-regulation study skills but were part of the normal course content. Students were expected to develop their self-regulation skills by being informed of their scores and then to self-reflect and modify their study behaviours to address the areas needing improvement. The study compared the pre- and post-study MSLQ scores and reported that students were able to improve their self-regulated study skills by being made aware of the areas that they needed to improve, thus encouraging them to self-reflect and adjust their study behaviours accordingly.

In another study, Goh et al (2012) used text messaging to help first year university students improve their academic performance and their self-regulated learning skills. In this study, a number of persuasive text messages were sent to students reminding them about various topics to study at different times in the semester, as well as reminders about deadlines for tutorial and other activities. By comparing the academic performance outcomes of an experimental and a control group they were able to conclude that the text messages had been effective. They also compared pre- and post-study the MSLQ scores to report that the students' self-regulation study skills had also improved. Although in this study the persuasive text messages were effective, the study did not target the text messages according to particular self-regulation learning strategies.

There is widespread agreement about the importance of self-regulated study skills, however there is a lack of accepted interventions especially designed to develop these skills. This study will use the MSLQ framework developed by Pintrich et al (1991) for identifying and promoting the development of cognitive learning strategies

associated with self-regulated learning skills. The MSLQ is a well-established and reliable instrument to use for measuring self-regulated learning strategies (Garcia, et al., 1993) as it is a self-reported system, however previous studies (Garcia, et al., 1993; Zimmerman, 2000) have demonstrated a close positive relationship between learners' MSLQ scores and their academic performance. The complete MSLQ is designed to “assess students' motivational orientations” to study (Pintrich, et al., 1991, p. 3), as well as assess the application of various learning strategies.

The MSLQ consists of two sections: the motivational section and the cognitive learning strategies section. There are 81 questions in total, 31 of which are related to the motivational section and the remainder to cognitive learning strategies and management of different resources. The sections are modular, so the MSLQ can be administered as a whole, or in modules to suit particular needs.

Since the focus of this study is on the development of self-regulation skills, only the cognitive learning strategies section of the MSLQ will be used, as these strategies are aligned with the self-regulation skills and have been used in previous studies to measure such skills (Dabbagh & Kitsantas, 2004; Garcia, et al., 1993; Zimmerman, 2000).

The cognitive learning strategies identified by Pintrich et al (1991) include six components:

1. Rehearsal: involves reciting, memorising and recalling important terms associated with the learning activities.
2. Elaboration: allows students to form connections between words, ideas and concepts.
3. Organisation: involves using appropriate techniques to form groups of related ideas, selecting main ideas from a topic.
4. Meta-cognition: the ability to apply previous knowledge to new areas to solve problems, make decisions or critically evaluate.
5. Time and study space: involves scheduling, planning and managing study time effectively.

6. Self-effort: the ability to control effort and attention when faced with distractions and disturbances during study.

Students' capabilities across each of these skills will vary, for example, some students may be competent with rehearsal but less competent with organisation. The text messages were designed to help students develop their weakest study skill.

5.3.2 Classification

According to Bernstein (1971), 'classification' refers to "the degree of boundary maintenance between contexts" (p. 88). Some examples of this classification include the boundaries that exist between different subjects at university and the knowledge that is gained inside and outside the classroom (Chen, et al., 2007). Bernstein's theory offers a means to conceptualise and explore these boundaries and examine how these characteristics can be applied to mobile learning.

Classification theories can be expanded to include classification in terms of formal learning spaces, where students attend tutorials or lectures and have allocated study time, normally on campus; and informal learning spaces, where students undertake learning activities outside formal settings (for example, having a discussion about university course work with a fellow student at the coffee shop).

These formal and informal learning spaces also operate within virtual and non-virtual environments. For example, students may use informal social networking sites to collaborate on formal university-related topics or use their mobile phones to organise social events during formal lectures. In the case of mobile phones, students could be "transported" (Hjorth, 2005) from informal learning spaces to formal learning spaces. For example when students receive a text message from their tutor about a university topic while they are attending to carer duties, they may momentarily pause their activities and attend to the formal interaction while typing a response to the text message. In this example, students are 'transported' from the physical space to a virtual space and are engaged in a cognitive study-related state. The physical location in this example represents the students' informal learning space, however, by

attending to their text message, students remain engaged with their learning even when they are located in informal learning spaces.

These classifications can also be used to define the way in which students interact with other students. For example, students may want to keep their private lives separate from their fellow students, choosing to socialise and interact with only a select few. Students choose these friends on the basis of similar backgrounds, hobbies, sports, work, etc. Not many students select friends based on what they might know about the subject.

Another study has also reported that mobile learning seems to “blur the lines between formal and informal learning” (Gikas & Grant, 2013, p. 24). In this study it was concluded that “connections must be made between curriculum and the devices” (Gikas & Grant, 2013, p. 24) to enable students to continue their learning outside of class times. They further report that students perceive using mobile phones for study as a positive initiative and most were engaging with other students on study-related subjects via social media outside of formal class times.

Studies that have used social media and other Web 2.0 technologies to support student learning, report that students often willingly switch between formal and informal contexts (Gikas & Grant, 2013). Other studies demonstrate that it is possible to force students to switch between formal and informal learning contexts by interrupting their activities using technology. For example, when students are not actively involved in study related activities, it would be possible to ‘transport’ them to a cognitive state where they start to at least think about studies, by interrupting them using a persuasive text message. Mobile phones, and in particular text messaging, provides an ideal medium to interrupt students in their informal contexts and engage them with formal study-related activities.

5.4 Design and context

The research aimed to investigate how text message technology could be used to help students to improve their cognitive learning strategies of the self-regulated study skills. The ubiquity and convenience of mobile phones make it an ideal platform for mobile learning. The majority of the mobile learning studies have enabled students to

access course content via their mobile phones, as well as collaborating through mobile social media and other advanced features of modern mobile phones requiring fast and reliable internet connectivity (Gikas & Grant, 2013). Other studies, such as the one conducted by Goh et al (2012) have demonstrated how text messaging can have a positive impact on students' learning outcomes.

5.4.1 Setting

This study was conducted with a cohort of first year Bachelor of Education students at the University of Wollongong who were enrolled in an educational technology subject. The University is a regional university in the state of New South Wales, Australia and currently has over 30 000 enrolled students. Although about one third of the students are International students, all the participants in this study were Australian domestic students. The cohort was chosen because it was a compulsory first year subject, and while helping students develop better study skills through the use of relevant technology, students would also be introduced to concepts about the use of technology to support learning.

5.4.2 Design of the learning environment

The researcher consulted the subject coordinator and the content, assessment tasks and tutorial activities were discussed and ideas on how the use of text messaging could be used were negotiated. So as to support students, it was decided that the first six weeks would be the most appropriate time to carry out the study as students are transitioning from their previous schooling to university. This study aimed to develop students' cognitive learning strategies of the self-regulated learning skills (Pintrich, et al., 1991) by engaging with them in formal and informal learning spaces by sending a number of text messages at different times over a six-week period.

The content of the text messages was composed using using the cognitive learning strategies of the MSLQ framework by Pintrich et al (1991). The MSLQ Manual contains generic instructions to help students develop their self-regulation learning skills. These instructions were adapted for text messaging, adhering to the 140 character limit and readability on mobile phones. The timing of the messages was determined using classification theories about formal and informal learning.

The study was introduced to the students during the lecture. The researcher then visited each of the tutorial classes to explain the study and answer students' questions. The information sheets and consent forms were distributed and participants were required to complete the online MSLQ questionnaire and provide their names and mobile phone numbers.

The MSLQ (Pintrich, et al., 1991) was used to identify each student's competencies for each of the six cognitive learning strategies through an online version of the questionnaire that was developed and administered to the participants at the start of the study. This provided a baseline score indicating how each student's individual strengths and weaknesses related to the six self-regulated learning strategies. Although all six cognitive learning strategies are important for successful university study, this study aimed to target the learning strategy in which students were least competent, and provide individualised, relevant support to help them improve their weakest learning strategy.

The calculated data from the online MSLQ, as well as students' names and mobile phone numbers were exported to Excel spreadsheet software for manual analysis and categorisation. Students were categorised according to the self-regulated study skill that they needed most support in, for example, all students who scored the lowest in the MSLQ questionnaire for rehearsal were categorised as 'rehearsal students'.

Text message communication between one-to-one users or even one to a few users is very common and relatively easy to initiate and manage directly from mobile phones. Disseminating multiple text messages to a large cohort, however, requires a system that is capable of efficiently managing a large number of text messages. There are various online tools available for this which is generally referred to as 'SMS gateways'. These allow users to send and receive text messages through an online website, and are a convenient option for managing large numbers of text messages. Most of the SMS gateways have been used successfully in mass marketing campaigns and disaster management applications (Shelke & Paranjpe, 2009; Vigar-Ellis, et al., 2007).

The online SMS gateways allow users to create an account, purchase credit to send text messages and keep track of all text messages sent and received. A number of these SMS gateways also enable users to customise the text messages to indicate to the recipient who the sender is, forward all received text messages to an email account, create templates of text messages, import a contact list from various sources and schedule text messages to be sent automatically at different times.

For this study, the Global SMS gateway (www.msgglobal.com, 2015) was selected as it provided reliability through a local support office, it was relatively easy to integrate the online tools with desktop email software packages, and it was able to schedule messages to be sent at different times. All the messages adapted from the MSLQ Manual (Pintrich, et al., 1991) for each of the self-regulated learning strategies was saved on the SMS Global gateway as templates. During the preliminary study, students indicated that they were not comfortable receiving text messages from unknown numbers, so the gateway was configured to indicate to students that the messages were coming from the researcher's mobile phone number.

The complete list of all participating students' names and mobile phone numbers were categorised according to the six self-regulated learning strategies and was imported from an Excel spreadsheet and merged with the relevant text message template. The text messages were then scheduled to be sent automatically by the SMS Global gateway at determined days and times in accordance with the classification theories. (The complete list of all text messages is included as Appendix J).

Students' text message responses were automatically directed to the researcher's email. In subsequent weeks, these same messages were sent again with the wording of the message changed slightly, without changing the content of the message.

In the final week, students were requested to complete the online MSLQ again, as well as complete a survey which explored their experiences with receiving text message prompts to promote their study skills. Students were also requested to participate in a face-to-face interview to provide further information about their experiences. Figure 1 below gives a pictorial representation of this implementation.

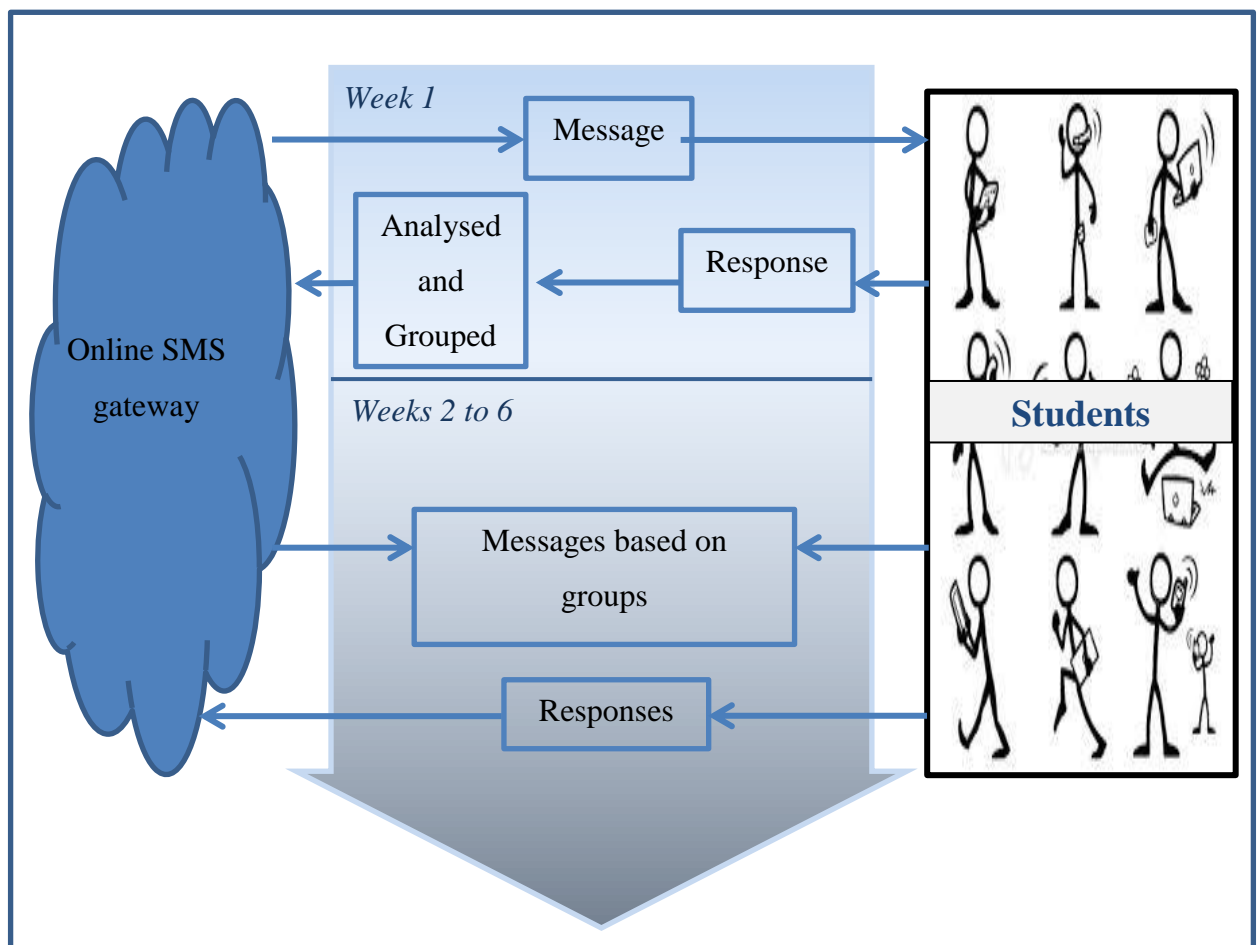


Figure 6: Pictorial representation of the implementation of the study skills development program

5.5 Discussion

This paper has explained the design of a theoretically-based mobile learning environment that supported first year university students to develop independent study skills. Some issues that have surfaced through this design process are discussed below.

Much of the current literature on mobile devices for learning focuses on using some of the more advanced features of these devices, such as fast internet access to provide access to university resources and/or facilitating Web 2.0 and other social media-related learning activities (Gikas & Grant, 2013; Grønli, Hansen, & Ghinea, 2012; Liu, Lin, & Paas, 2013). While these are innovative approaches for applying these devices in learning applications, basic commonly-used features of all mobile phones still provide useful opportunities to engage students and help them develop essential

study skills. The text messaging feature is available on all mobile phones and is accessible over basic telephone connectivity. It does not require fast wireless internet connectivity, or access to any Wi-Fi networks. Compared to other forms of wireless communications such as wireless internet, text message communications are also relatively cheap. This makes text message communication an easily accessible technology for students and it can be implemented relatively easily by teachers to support student learning. Teachers would need to gain access to an online SMS gateway (www.smsglobal.com, 2015) to send and receive bulk text messages. The cost of using an online SMS gateway varies depending on the type of service and number of text messages sent and received (approximately four cents per text message sent). Teachers would also need to set up a simple database of their students' names and mobile phone numbers using spreadsheet software such as Microsoft Excel to enable the SMS gateway to schedule messages as required. Students need a basic mobile phone without the need to have smartphone capabilities or access to internet connectivity. Studies show that most students already own mobile phones (ACMA, 2012-2013). There are limitations, however, for using text messaging in learning. The size of each text message is limited to 140 characters and therefore the way in which the text messages are composed needs to be thought through to ensure there is no ambiguity within the restricted word limit.

Although text message as a communications technology is fairly well developed and established, very few applications exist that integrate it into teaching and learning environments. Very few, if any, integrated applications exist that enable the management of text messages from within institutional learning management systems (LMS). Although technologies for integrating text messaging into LMS exist, there has been limited effort to try to do so. Instead, more energy has been put into ensuring that the LMSs are mobile capable, that is, the content available on the LMS are easily accessible via mobile phones and other mobile devices. Implementing text messages for learning, therefore, requires the use of various external tools which are often not seamlessly integrated. For this study, an account with an online SMS gateway was acquired. SMS gateways are online portals that enable sending and receiving of bulk text messages via a web interface. Most effective SMS gateways allow users to create message templates, schedule messages to be sent at particular

times, and redirect received messages to other systems like email packages or mobile phones. The student details including mobile phone numbers and the types of messages to be sent were collected through a separate online MSLQ before being manually exported to offline spreadsheet software. This information had to be once again manually imported into the SMS gateway and each message individually scheduled to be sent at different times. Students sometimes perceive electronic material and/or support available outside of their institutions' LMS to be less important and they are therefore less likely to use it for learning purposes (Ting, 2012). A completely integrated system delivered through the University LMS is likely to be more effective in engaging students by ensuring connectivity was maintained using just one system (Gikas & Grant, 2013).

A completely integrated system could also lead to further personalisation of the support provided to students. The support prompts and the text messages were customised by ensuring that each student only received the messages that related to his or her weakest study skill. In addition, each message was further customised by use of the student's name. It would be possible to provide further customisation, whereby each student could receive individual support as needed by requesting it via text messaging. This would allow students to be productive and continue with their study by getting immediate, targeted feedback.

Although an increasing amount of research is being conducted to use mobile technologies for teaching and learning, much still needs to be known about how to effectively implement mobile technologies for learning. Mobile learning is generally discussed in the context of formal and informal learning. The ubiquitous nature of mobile phones in particular is seen as being able to provide opportunities to provide continuity in learning between formal and informal learning situations. The literature, however, contains rudimentary conceptualisations of formal and informal learning.

Classification theories discuss that students tend to maintain boundaries between various aspects of their lives, including the time they spend on studying inside and outside class (Chen, et al., 2007). A number of studies consider informal learning as learning that occurs outside classrooms and formal learning that occurs inside

classrooms (Andrews, et al., 2010; Breuer, et al., 2007; Gu, et al., 2011; Kekwaletswe & Ng'ambi). While these definitions are useful, it does not fully define the full spectrum of formal and informal learning. For example, when students follow explicit instructions from teachers to use their mobile phones to collect pictures and other artefacts outside of class according to aspects that were discussed in class is considered informal learning as students are engaging in learning activities outside of class, but since they are still within the bounds of the course objectives their activities can still be considered formal. Formal and informal learning can then be more effectively defined using the domains on *intent* and *structure* (Sefton-Green, 2004). (For a more thorough discussion on this please refer to Chapter 2)

Intent refers to how closely a learning activity is aligned with the identified objectives of a course or subject. In the above example where students were instructed by the subject teacher to collect artefacts that related to their subject topics using their mobile phones can be considered as a learning activity that is formal according to intent. However, when the students were outside class they were able to choose, without teacher intervention, the types of artefacts they choose and where they collected them. This freedom of choice indicates that the learning activity was still not absolutely intentional.

Structure on the other hand refers to the physical structures where the learning takes place. Once again in the above example where students use their mobile phones to collect artefacts outside of class, the learning activity is taking place in an informal structure. Learning activities that take place inside classroom or lecture theatres are considered formal according to structure. As in the above example, typical learning activities may start inside a classroom, move outside the classroom and then move back inside the classroom, there learning activities can be identified as falling on a continuum of formal and informal according to structure based on the amount of time spent inside and outside classroom.

Studies have shown that students tend to be more engaged with learning activities that are formal according to intent (Boud, et al., 1999; Rapetti, et al., 2011). Informal learning on structure on the other hand can provide more authentic experiences

(Guralnick, 2005; Timmis, 2012). Mobile learning implementations must attempt to find the right balance between formal and informal learning according to both intent and structure.

The study skills development program designed in this research conceptualised informal learning according to intent and structure. The study skills development program was designed to support the development of adjunct study skills, which although is important for the overall and long term success of students, is not explicitly part of a course or subject that students were enrolled in. In this sense the study skills development program was informal according to intent. The study skills development program engaged students outside of class time to practice appropriate study behaviours, and therefore was informal according to structure as well.

5.6 Conclusion

This paper has described an effective design of a mobile learning activity to promote the development of independent study skills among first year higher education students. Independent study skills are correctly recognised as essential to prepare students to cope with the demands of higher education studies in their first year and beyond, and are expected to become even more important as more and more institutions move towards student-centred learning environments.

Mobile phones are becoming ubiquitous, and utilising students' own mobile phones to develop their self-regulated study skills can be highly effective and engaging. The theoretically-based mobile learning implementation described in this paper can be effectively used to develop similar generic study skills.

5.7 References

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6 USING MOBILE LEARNING TO DEVELOP SELF-REGULATED LEARNING SKILLS

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6.1 Abstract

This study helped participants to develop their self-regulated learning skills by providing relevant study skills development support via the text messaging mobile technology. The study was conducted with a group of 69 first year Bachelor of Education students at the University of Wollongong. A targeted text message-based support to help participants develop their self-regulated learning skills was created by identifying each participant's individual self-regulated learning skills need using a pre-activity cognitive learning strategies sub-scale of the Motivated Strategies for Learning Questionnaire (MSLQ). Qualitative data were collected in the form of an end-of-study student questionnaire and a face-to-face interview. The findings of the study indicate that this study was effective in identifying participants' self-regulated learning needs and then providing appropriate support for the development of their self-regulated learning skills. Participants also reported that the study had been effective in helping them to improve their self-regulated learning skills. This study indicates that appropriately design mobile learning can be effective in helping students develop effective study skills.

6.2 Introduction

Previous studies have identified that first year university students are generally inadequately prepared to cope with the demands of university study (Skene, et al., 2006; Taylor, 2008). University students need to be able to apply effective independent study skills in order to manage the demands of university study. Independent study skills are particularly important as universities adopt sophisticated teaching and learning approaches like experiential and authentic learning (Laurillard, 2002). As an independent learner, students need to be able self-regulate their learning, that is, they should be able to take charge of their own learning and practice effective study behaviours that lead to their overall success at university (Zimmerman, 2000). Effective self-regulated learning skills have been shown to have a positive impact on student's academic achievement (Cleary & Platten, 2013).

Self-regulated learning is a broad concept that includes a number of skills and abilities (Zimmerman, 2000). The self-regulated learning framework developed by Pintrich et al (1991) includes the motivational and cognitive learning strategies scales. (For a complete description of the self-regulated learning framework please refer to Chapter 5)¹

It is possible to identify students' ability to use each of these cognitive learning strategies of the self-regulated learning skills components, and more importantly enable students to develop these components independently (Garcia, et al., 1993). Although some students can develop these skills on their own, most need explicit help to develop these important study skills (Torrano & Torres, 2004). Given the significance of self-regulated learning skills on students' success and performance at university studies, the development of these skills cannot be left to chance, universities must explore effective strategies to help students develop these skills. There is an increasing number of studies that have focussed on develop university students self-regulated learning skills (Duckworth, et al., 2009).

At the same time, higher education institutions are experiencing a growth in the use of wireless mobile devices amongst their student populations (Oliver, 2007). Research in the use of wireless mobile devices for education and learning has also increased (Naismith, Lonsdale, Vavoula, & Sharples, 2004). Studies have demonstrated that mobile wireless devices are effective in enabling students to connect conveniently to universities' learning resources and management systems as well as enabling prompt communication between students and teachers (Bollen, et al., 2004; Dyson, et al., 2009; Markett, et al., 2006). Mobile phones are the most ubiquitous of all mobile devices used by students and text messaging is the most used communication feature (Cobcroft, Towers, Smith, & Bruns, 2006). More recently mobile phones have been used to support students learning including supporting students to develop self-regulated learning (Connor, Newman, & Deyoe, 2012; Goh, et al., 2012; Sultan & Mohan, 2012). Although the ubiquitous and personal nature of mobile phones lends itself as a suitable technology to support individualised learning (Laurillard, 2002),

¹ These references to other sections of the thesis will be removed when submitting this chapter for publication.

there is a lack of evidence in the literature to indicate that mobile phones have been used to identify students individual study skills needs and provide customised support to each student based on their need.

This study demonstrated a novel approach to helping first year university students develop their self-regulated learning skills. The study used existing self-regulated learning framework to identify students' individual study skills need and provided targeted, text message-based support, based on their individual learning need. The findings indicate that mobile phones are an effective medium for the development of students' study skills for university students.

The design of the self-regulated learning program, research methodology, data collection and analysis strategies, results and discussion of the results are presented in the following sections.

6.3 Design of the study skills development program

A study skills development program was designed and implemented as part of this study. The program was designed to identify students individual study skills needs and then send them a number of text messages during their outside class time to help them to develop their study skills. This study skills development program was based on self-regulated learning theory and the development strategies were based on the cognitive learning strategies sub-scales of the self-regulated learning framework (Pintrich, 2004).

An online version of the Motivated Strategies for Learning Questionnaire (MSLQ) was created to enable identification of student's individual capabilities to apply the cognitive learning strategies of the self-regulated learning skills. The MSLQ Manual contains generic instructions to help students develop their self-regulated learning skills (Pintrich, et al., 1991). These instructions were adapted for text messaging, adhering to the 140 character limit and readability on mobile phones. The messages were sent at different times of the day using a web-based SMS gateway (www.smsglobal.com, 2015). Students were sent different set of text messages based on their needs as identified using the MSLQ questionnaire.

The researcher consulted the subject coordinator and the content, assessment tasks and tutorial activities were discussed and ideas on how the use of text messages could be used were negotiated. So as to support students effectively, it was decided that the first six weeks of classes would be the most appropriate time to carry out the study as students are transitioning from their previous schooling to university.

(More details about the design of the study skills development program is provided in Chapter Five of this thesis²).

6.4 Methodology

The study was conducted with a cohort of 69 students from the first year Bachelor of Education who were enrolled in an educational technology subject (which was compulsory for first year students) at the University of Wollongong. While the compulsory subject aimed to develop students' study skills using relevant technology, it also introduced students to concepts relating to the use of technology to support learning.

The use of mobile phones for the development of students' self-regulated learning skills is a relatively new concept, even though a number of studies have used and studied mobile phones to support learning generally. Studying the development of learning skills is complex and requires careful evaluation. A case study approach (Yin, 1993) was used in this research to study the development of students' self-regulated learning skills as well as students' experience with participating in this mobile learning approach.

The study addressed the following research question: *“How can first year university students be supported to develop their independent study skills using mobile phone technology?”*

² The reference to other sections of this thesis will be removed prior to submission of this paper for review and a general reference will be made to this thesis for the interested reader.

6.5 Ethics

The study was approved by the University of Wollongong's Human Research Ethics Committee (UOW HREC approval number HE08/315, Appendix A). (For more details about the ethics procedures please refer to Chapter 3).

6.6 Data collection

At the beginning of the study each participant completed an online MSLQ. This was used to identify participant's individual competencies against each of the cognitive learning strategies sub-scales self-regulated learning skills. The text message support was designed to specifically target the weakest self-regulated learning skill component. This pre-activity MSLQ was also used as a quantitative base-line score of participants self-regulated learning competencies.

At the end of the study, participants were requested to complete the MSLQ once again. This post-activity MSLQ score was used to compare students' self-regulated learning skills with their pre-study scores.

Participants were also requested to complete an online end-of-study questionnaire which aimed to seek feedback in relation to their study habits, experiences with this study and perceptions about the effectiveness of the study. (A copy of this questionnaire is provided as Appendix G.)

All participants were invited to participate in a face-to-face interview. The interview aimed to provide rich feedback from students on similar questions to the questionnaire, but was designed to be more open-ended to enable students to provide rich descriptions about their participation and experiences with this study. (A copy of the interview questions is provided as Appendix H.)

Table 1 provides a summary of the total number of participants for each of the data collection methods. As can be seen from Table 1, 140 students initially volunteered to participate in this study and completed the pre-activity MSLQ. However 69 participants completed the post-activity MSLQ and the questionnaire at the end of the study period, out of which 11 participants took part in the face-to-face interview. This paper reports on the findings from the 69 participants.

Table 9: Total number of participants

		Number of participants											
MSLQ	Total	Pre-activity						Post-activity					
		140						69					
		Rehearsal	Elaboration	Organisation	Metacognition	Time and Study Space	Self-effort	Rehearsal	Elaboration	Organisation	Metacognition	Time and Study Space	Self-effort
	Study skills categories	58	8	19	41	14	0	28	5	12	20	4	0
Questionnaire		Not applicable						69					
Interview		Not applicable						11					

6.7 Data analysis

There were three main sources of data collected in this study. Analysis of each is described as follows:

1. MSLQ: Microsoft Excel spreadsheet software was used to create easy to visualise using the pre- and post-study data. A statistical t-test was also conducted to identify the significance of the pre- and post-activity MSLQ score.
2. Questionnaire: The questionnaire contained both qualitative and quantitative data. And therefore both quantitative and qualitative analyses were used as follows:
 - a. Quantitative analysis: involved creating summarised charts and graphs for each question in the survey. This provided high level understanding about students' responses to their experiences.
 - b. Qualitative analysis: involved aggregating all responses and then identifying common themes from the responses. Summaries of these identified themes were then created and are provided in this chapter by the researcher based on his interpretations of the collective students' responses.
3. Face-to-face interviews: The interviews were used to give students an opportunity to add personal perspectives about how they responded to the study skills development program used in this study. The answers to questions were interpreted by the researcher and themed summaries were provided next to each question. All the interviewees' answers were then compiled onto a

single table and further summaries were provided, capturing the themes for each question from all the interviewees.

6.8 Results

The results are presented below. A preamble of participants' profile is firstly provided to give context to the main findings.

6.8.1 Preamble: Participants' profiles prior to participation in the study skills development program

Participants' pre-activity profiles were created using the pre-activity MSLQ and various questions in the end-of-study student questionnaire and the face-to-face interview.

In summary the participants in this study indicated that they come from a diverse background, although a small majority are straight out of high school, a number of participants indicate that they have spent time in other post-secondary education, work or carer duties. All participants in this study owned and used their mobile phones frequently, with text messages identified as the most commonly used type of communication medium. However, mobile phones were the least used technology for supporting learning. Participants also indicated that they do not necessarily have any fixed place and time to study, and often have to fit their study around their busy extra-curricular schedules, however most participants indicated that they do tend to study at home more frequently than other places and often on weeknights. Participants, due to practical and preference, generally study independently. They recognise the difference between high-school study and university study expectations, finding university study a lot more challenging; however use the same study strategies that they had used in high-school. Participants' abilities with the various components of self-regulated learning differ between participants. For example some participants were able to report that they were very good with rehearsal strategies, but needed help with organisation, whereas some participants were good with organisation but needed help with rehearsal.

The specific results about participants' profiles before they engaged with the study skills development program in this study is presented in detail below:

6.8.1.1 Participants' background

Although a majority of first year university students tends to enrol directly from high school with little or no experience with any other higher education study environment, it became apparent during the face-to-face interviews, that a number of students also have some higher education study experience through their studies at other colleges such as TAFE. Six out of 11 participants who participated in the face-to-face interviews had some higher education study experience prior to enrolling in the Bachelor of Education course. Only one participant was male. These participants opted to enrol in non-university higher education courses while they figured out if and what they needed to study at university.

Further these participants reported that they find it challenging to cope with university demands. The following comment summarises this point:

I find that coming to this university and studying this particular course, a lot of the lecturers relate to us as if we're just from out of school, there's not really very much – I don't feel like I'm being connected with as a mature-aged student. (Peta, face-to-face interview)

Similar sentiments were echoed by another student who spent some time away from school and then attended colleges and other higher education institutions before enrolling in the Bachelor of Education course at University of Wollongong:

At the moment, it's really hard trying to find the time to do it. I think the way I usually operate is I don't study until say these last couple of weeks coming up to the exams. (Filomana, face-to-face interview)

All students who participated in the face-to-face interviews also mentioned that they have many extra-curricular commitments such as work, sports, church, and carer responsibilities. The typical non-university related activities of a first year university student who is straight out of high school is summarised as follows:

I work part-time at my church with the kids' ministry and yeah, very involved with the kids' ministry at church, I'm a trainee nurse, I play sports. (Cathy, face-to-face interview)

In summary, the participants in this study come from very diverse backgrounds. Although a small majority (60%) (n=6) of participants in this study were straight out of high school, there were a number of participants (40%) (n=5) who spent time either studying at another non-university-based higher education institution, working or looking after children and adults as carers. Once at university, the participants indicated that they are very time poor, often taking part in various extra-curricular activities outside of university time like sports, work, carer duties, volunteering or socialising. University studies were challenging for the participants in this study, they indicated that there was little or no support available to help them cope with the demands university studies.

6.8.1.2 Mobile phone use

All students in this study owned and used mobile phones frequently. The majority of mobile phones that participants owned were ‘smartphones’, with internet access and numerous other features akin to some computing devices. Regardless of their backgrounds and responsibilities outside of class, all participants keep their mobile phones with them all the time and the text messaging was the most commonly used communication application for most students. They consider mobile phone use an “essential part of their life. I’m always on it.” (Cathy, student questionnaire)

Figure 1 shows that the number of participants who use the various types of applications available on most smartphones today. All participants who completed the end-of-study questionnaire indicated that they use text messaging as the main application on their mobile phones, followed by using the phones as alarms and voice communications. Even though modern smartphones enable to access emails, internet and a number of other applications, text message communications was identified as the main application used by all participants. The following comment indicates how she uses her mobile phone:

Always SMSing. I SMS a lot. I also use it for the internet ‘cause I’ve got an i-phone so I use Facebook a lot. If I ever need to just search anything, you know, on the internet, I use it like that. But I kind of use my phone a lot. It’s kind of essential to everything I do. (Arti, face-to-face interview)

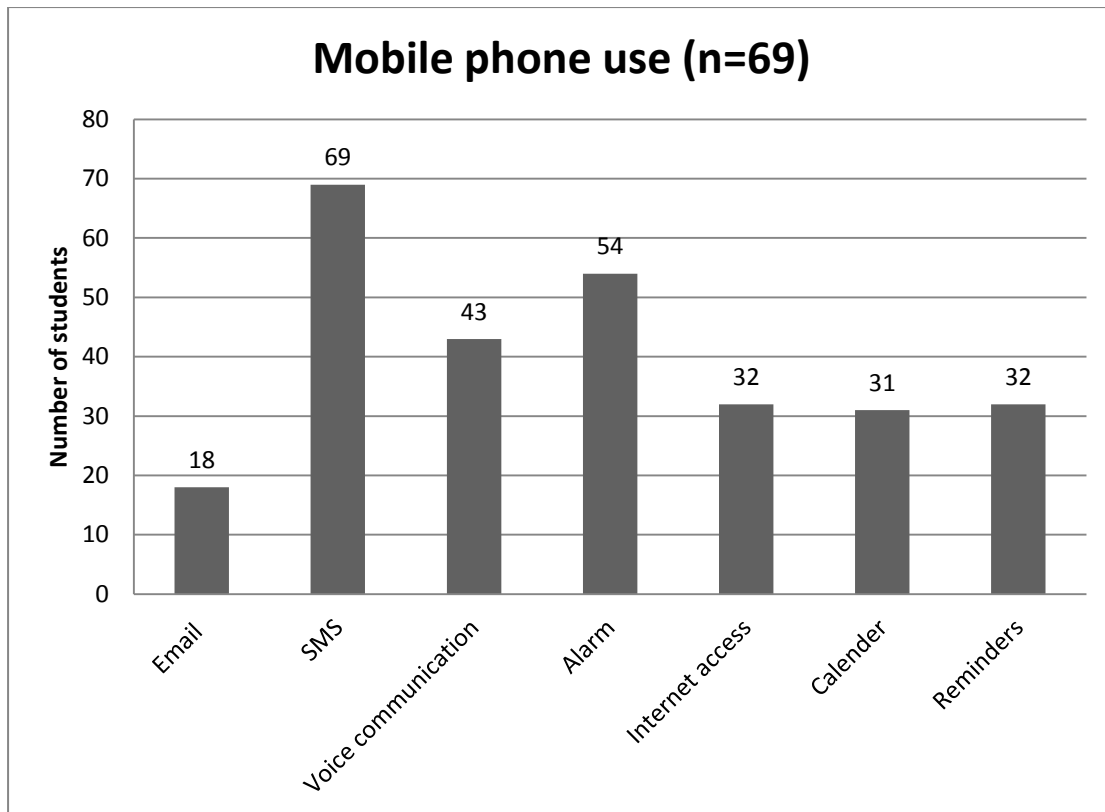


Figure 7: Participants' use of mobile phone

Participants reported developing effective systems of managing their busy text message communications. For example, they can scan their text messages and identify the relative urgency to attend to those text messages and act accordingly. This is illustrated by this comment:

Yeah I would say I categorise people in my life, that sounds really funny, and if it was my friends who I didn't particularly need to get back to for a while then it's not unusual for me to leave it a few days and get back to them because I'm busy at uni time. If it was like the most important group of my life I'd probably respond quite quickly or if not, in an hour or something like that. (Heicki, face-to-face interview)

In summary, all participants owned and used their mobile phones frequently, and text messaging was the most commonly used application. They seem to have developed highly effective strategies for maintaining text message-based communications with a variety of people in their lives.

6.8.1.3 Technologies used by participants to support their learning

Even though participants consider their mobile phones “an essential part of their lives” (Cathy, face-to-face interview), as indicated in Figure 2, it is one of the least used technologies to support their learning, only about 5% of participants indicated that they use mobile phones to help them study. The University’s learning management system was identified as the most commonly used technology to support learning.

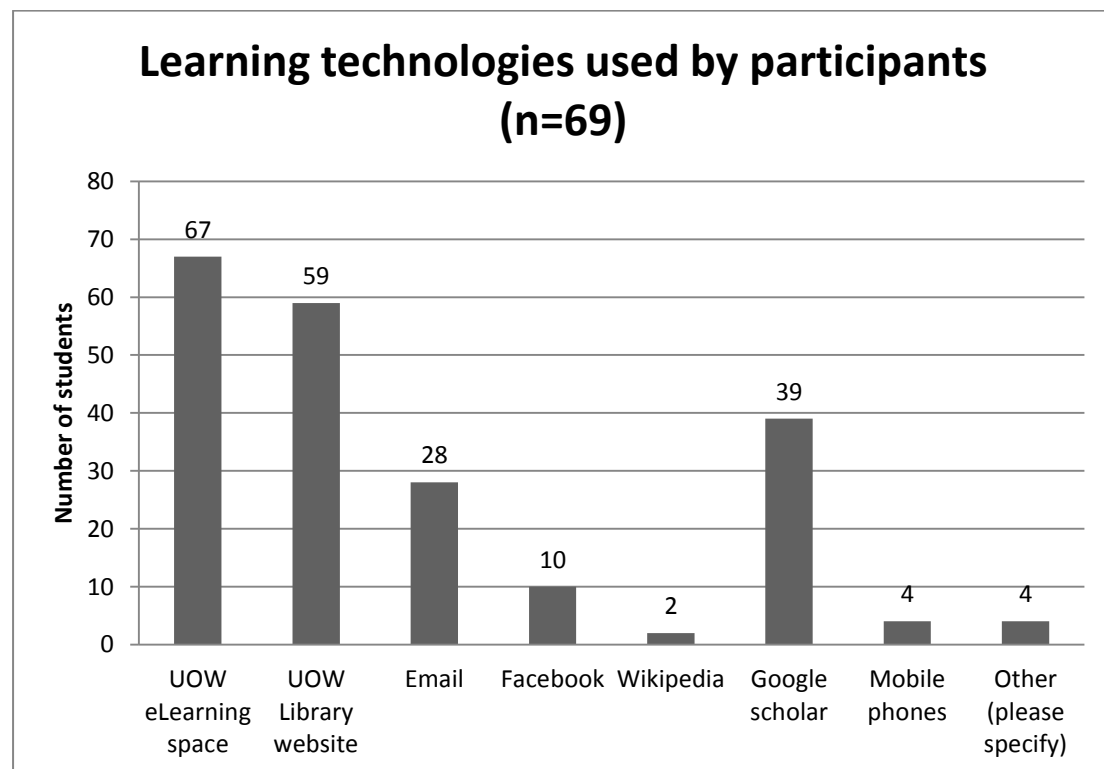


Figure 8: Learning technologies used by students

Although ten participants indicated, in the end-of-study questionnaire that they use Facebook to help them with their studies, all participants in the face-to-face interviews indicated that they prefer to get study supports provided through text messages rather than social media. This comment from a participant summarises why students may prefer text messaging over social media:

With SMSs they’re more like a private kind of thing whereas your interaction is slightly different than if it’s Facebook, it’s more a public thing. Things might not seem as important, like if you look at an SMS you think of it as more important against something on Facebook ’cause it might not be, you know, they haven’t gone to the effort of actually sending you a message, they’ve just

posted it on the internet kind of thing so that's what I think. (Arti, face-to-face interview)

In summary, the participants indicated that they do not use their mobile phones to support their learning. However, they commented that they would prefer to receive study support from university through text messaging on their mobile phones rather than social media messaging.

6.8.1.4 Participants' preferred study times

The participants in this study were pragmatic about their study times, they would study when they find time to do so, as indicated by the following comment:

I have a number of activities during the week such as tutoring 5 children, teaching dancing classes 3 times a week and leading at my youth group and attending church. I work better during the day and in the mornings but if I have to will stay up late to get it done. (Zillinsky, student questionnaire)

Seventy-five percent of participants do not have any particular time/day preference for studying. They tend to "fit study in whenever I can around everything else in my life" (Peter, student questionnaire). Although participants study whenever they can find time, they did indicate their study preferences as presented in Figure 3. As can be seen from Figure 3, 46 participants (out of 69) indicated that their preferred time to study was weeknights, followed of 43 who prefer to study weekdays, 38 participants prefer to study day time weekends with only 16 participants indicating that they prefer to study on weekend nights.

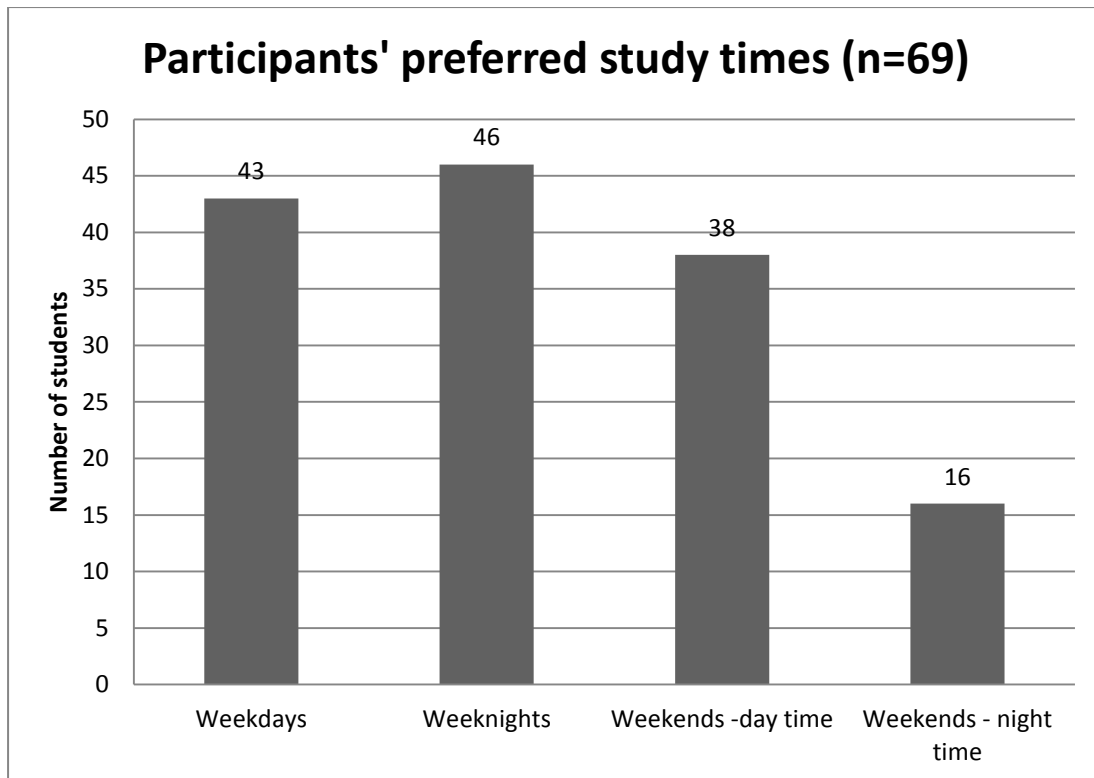


Figure 9: Participants' preferred study times

The participants were clearly more productive during their chosen study times/days due to a range of factors including their various extra-curricular commitments. “I have limited time during the week and weekends are usually free, giving more time to concentrate on the work.” (Shannon, student questionnaire)

In summary, the participants in this study indicated that they fit their study whenever they can find time to do so, often working around their various other extra-curricular commitments, however weeknights was the most popular time to study.

6.8.1.5 Study Location

The places where participants choose to study vary. Some participants indicated that they prefer to study at home as there can be too many distractions at university, however students will often utilise the breaks between classes at university to study:

Yeah, most of my study is done at home, because I get too distracted on campus but in study breaks, often between classes and things like that, as the semester's gotten more busy I've done a bit at uni but most of it is done at home for sure.
(Heicki, face-to-face interview)

Most participants chose two or more locations as their preferred location, reinforcing earlier comments that they will study whenever, and wherever they can find a convenient time. As shown in Figure 4, 97% of participants find it convenient to study at home, followed by the university campus including at the university library (64%). Ten percent of participants indicated that they prefer to study at a friend's house or even at their parents' workplaces. These other study locations also include "while commuting to/from university" (Filomana, student questionnaire), as well as parents' workplaces.

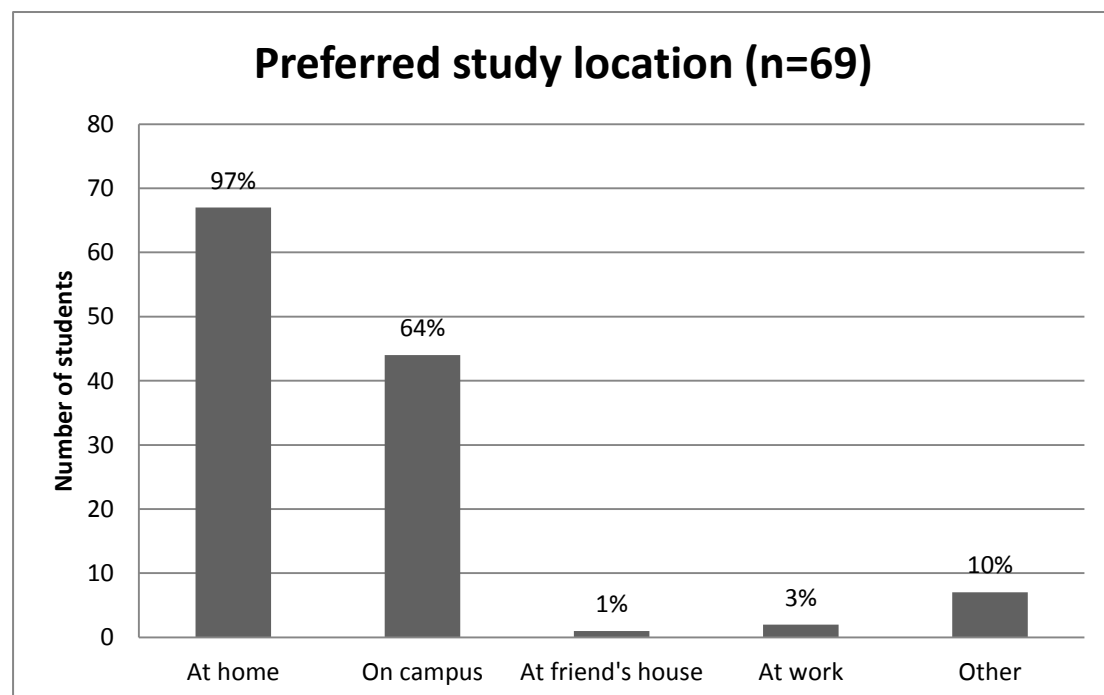


Figure 10: Preferred study location

In summary, participants indicated that they study at different places as suitable based on their various extra-curricular activities and class scheduled, however majority of the participants commented that they do most of their studying at home.

6.8.1.6 Participants study style: collaborative or independent

The participants in this study indicate that they prefer to study independently. As indicated in Figure 5, 95% of participants preferred to study independently. Only one participant indicated that she prefers to study exclusively with her friends. The remaining participants who indicated that they preferred to study with their friends

also indicated that they would prefer to study by themselves first and then collaborate with friends to clarify issues. Just over 5% of participants indicated that they preferred other study styles. Two of these participants indicated that they study with the help of their parents. For example “I usually talk to my mother about the subjects, bouncing ideas off her and talking about what I know.” (Tian, student questionnaire)

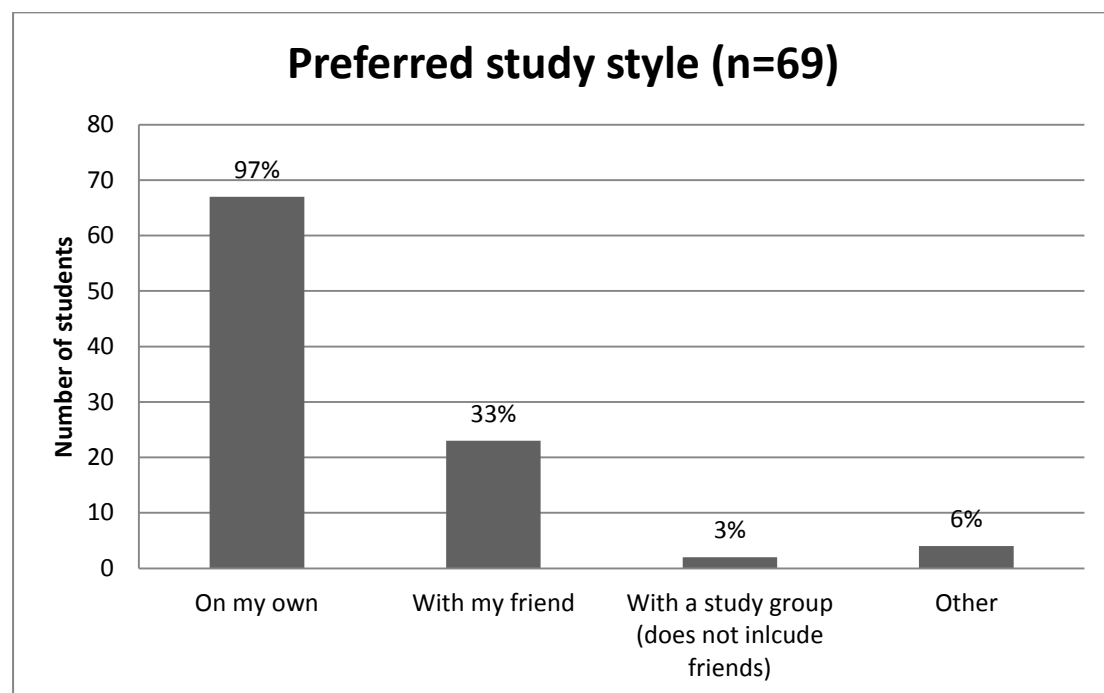


Figure 11: Preferred study style: collaborative or independent

In summary, participants indicated that they prefer to study independently. Even when participants study with a friend, they tended to do their initial study independently before collaborating to discuss issues.

6.8.1.7 Study habits

From the face-to-face interviews it was highlighted that participant study habits were unstructured, and generally aligned with the study strategies associated with the rehearsal component of self-regulated learning skills. For example the following comment indicates this point:

Study session consists mainly of reading and sometimes I write notes if I find something that resonates or that I think is really important but I do find that when I’m reading I tend to change the way I read. (Peta, face-to-face interview)

Similar comments were made another participant:

So I read the text that was prescribed to read, the recommended readings and I used to take notes when I was reading those and I found that now, actually it's better to read it because a lot of it isn't required so I'm taking that approach now. (Heicki, face-to-face interview)

Participants tended to adopt whatever study strategy that they think worked for them. One participant did indicate during the face-to-face interview that he needed help from his parents to get organised to study when he was in high school:

Mum was like, "This is what we're going to do", so she'd draw up the whole timetable thing, the study timetable and I got better marks than I expected. (Sherine, face-to-face interview)

He added that now that he is at university he finds it difficult to get organised:

If it's a little bit too early then I don't feel – I find myself sitting down and then not doing anything, just getting distracted because I know in the back of my head that I'm not – there's no urgency to do it sort of thing, it's more of I need a little bit of pressure to get the work done. (Sherine, face-to-face interview)

Another participant, Toni, indicated during the face-to-face interview that she was not very good at employing a structured study strategy, however after attending a study skills workshop in high school, she became a lot more structured with her studies:

Well, I was a bit lazy until about Year 11 and 12. I didn't study much for the School Certificate or anything but in Year 11 and 12, they guided us a bit. They had some people come in and give us some study skills sessions and training things like that, and I started. I was still a bit behind, I'd leave things to the last minute a bit. (Toni, face-to-face interview)

In summary, participants indicated they have difficulty in studying . They utilise whatever study strategy they know, often using same strategies that they had used in their previous studies.

6.8.1.8 Participants' perceptions about university study versus high school study

During the interviews, participants were asked what they thought were the main differences in study expectations between university and high school. All participants commented that they find university study requirements different to what was expected of them in high school. As expected, participants realise that they need to do

a lot more independent work at university, however being at university can also be very distracting:

It's very much dependent on yourself, which high school was towards the end but this is even more so. I think the most noticeable thing for me though has been the social side of it so not seeing the same people five days a week for six hours in a day but yeah, it's a lot more – you choose how much you go to and how much you want to invest into it. (Cathy, face-to-face interview)

Even though more independent work is required from participants, they also indicate that not much support is provided to them about how to work independently.

Participants indicated that they tend to employ similar study strategies that they used in high school, however they do acknowledge that university is significantly different to high school: "It's harder to write summary notes, I guess teaching myself was the most part of it" (Cathy, face-to-face interview). Participants recognise that there is little or no study skills support available at university and therefore use whatever study strategies they think will work for them.

In summary, for practical reasons as well as preference, the participants in this study indicated that they study independently. Most of their study involves working at home or in places where there is little distraction from others. Also since participants are engaged in various extra-curricular activities, attempting to study with others would be impractical.

6.8.1.9 Participants' current study skills

The Motivated Strategies Learning Questionnaire (MSLQ) is based on the self-regulated learning framework and can be used to identify students abilities with each of the components of self-regulated learning skills (Garcia, et al., 1993; Goh, et al., 2012). This study used the cognitive learning strategies sub-scale of the MSLQ. At the beginning of the study, participants were required to complete an online MSLQ questionnaire. Each participant's MSLQ score was analysed to identify their weakest self-regulated learning skills component. The text messages that students received was to help each student improve their weakest cognitive learning strategy of the self-regulated learning skill component.

For example, the study self-regulated learning skills of one randomly selected participant is shown in Figure 6. This student was randomly selected from the participants to demonstrate the way in which the individualised text message support was selected for each participant.

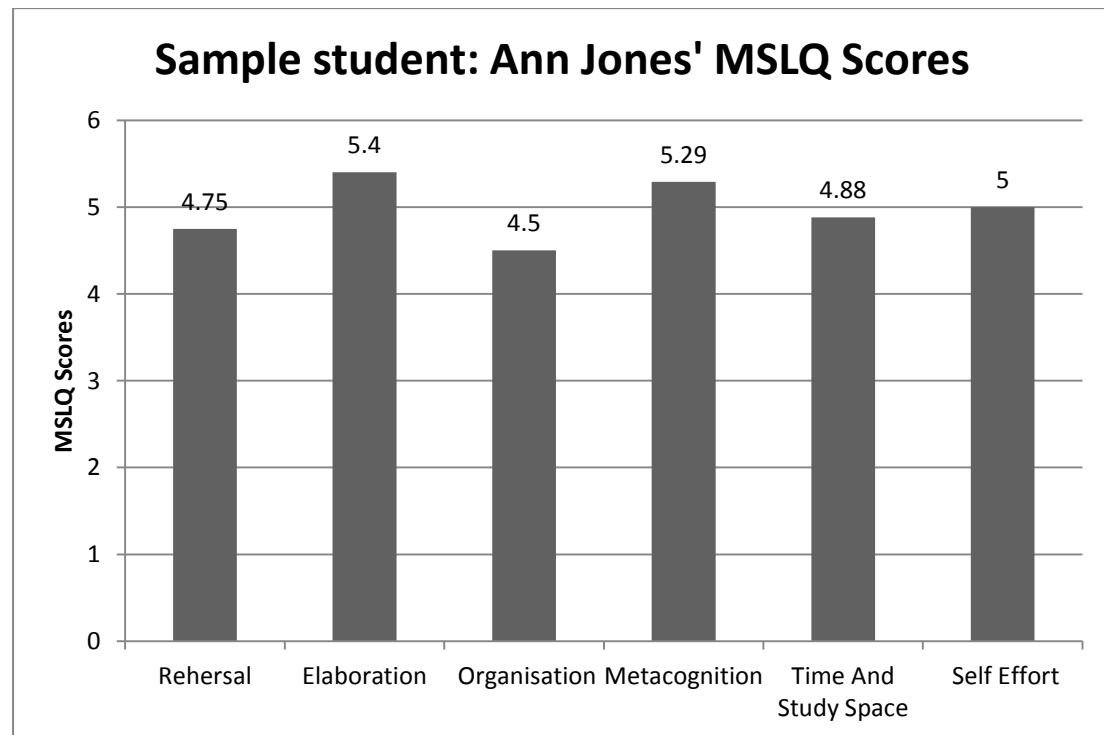


Figure 12: Example of Ann Jones' (randomly selected student) MSLQ scores

What is evident from the above chart is that this particular student is weakest in organisation skills and therefore all the study support that she received via text messages was designed to help her improve her organisation skill. A complete list of the entire self-regulated learning skills components and their relevant strategies to study for each of the components, which was used to develop each of the text-message-based support strategies, is provided as Appendix F.

6.8.2 The main results: Participants engagement during the study skills development program

The results reported here are from all the 69 participants, including the 11 face-to-face interviewees. Participants were asked various questions in the end-of-study questionnaire and the face-to-face interview about their experiences participating in this study.

In summary, the study skills developed program implemented in this study aimed to engage participants to follow the instructions contained in the text messages they received. In order for the participants to engage with the instructions they needed to be able understand the text messages, follow the instructions immediately and/or follow the instructions at a later time. The findings indicate that the text message-based instructions were not ambiguous. Participants were able to understand the content of the instructions. They also reported that they followed the instructions when they could. For some participants, the time that they received the text messages was not convenient to follow the instructions, but was able to get back to the text messages later on when it was more convenient.

The results are reported in more detail below:

6.8.2.1 Were the text messages engaging?

In order to use text message-based study skills support, it is important to ensure participants are able to understand the instructions contained in the text messages. One of the constraints of composing messages for delivery via text messages was the 140 character per message limit imposed by the technology. The messages had to be clear and succinct enough to be unambiguous yet easy for students to understand and follow. Participants indicated that they were able understand the meaning of the messages and did not find them ambiguous. They also found the continuity in the messages useful and engaging as indicated by this comment:

Yeah there was a relationship between them and if there was sort of a progression of them, which was really helpful because when you're studying and we were trying to work out how to study, you can't usually see that yourself and so being able to – someone tell you that's the next step I went, 'Oh yeah, that's obvious', I wouldn't have seen that by myself. (Heicki, face-to-face interview)

Another student further commented that, apart from the SMS content being useful for her studies, getting the messages as an SMS instead of an email was more effective as SMS tends to capture one's attention more effectively:

I think it's good because I think it's easily accessible, like people don't necessarily always check their emails or if you put it up on, I don't know SOLS

or something, people just go, “Oh ...”, you know, “Ignore ...”, or whatever whereas if you get it on your mobile it’s kind of, oh no I find it – everything’s on my phone like reminders and things like that, so I find it helpful to have it with me. (Filomana, face-to-face interview)

In summary, participants in this study indicated that they were able to follow the study instructions contained in the text messages and that the use of text messages for study support was more appropriate than other technologies like email.

6.8.2.2 What did the participants do when they received the text messages?

Figure 7 shows that over 90% of participants who completed the end-of-study questionnaire indicated that they at least read the messages, with over 70% of participants reporting that they read the messages and followed the instruction either right away or after a little while. Participants were sometimes unable to follow the instruction as soon as they received them as they were busy with other duties like work, caring for children or sports. The participants, who chose ‘Other’ as an option, commented that they were generally busy or doing something else when they received the messages so could not attend to it right away but did come back to it or plan to come back to it later on.

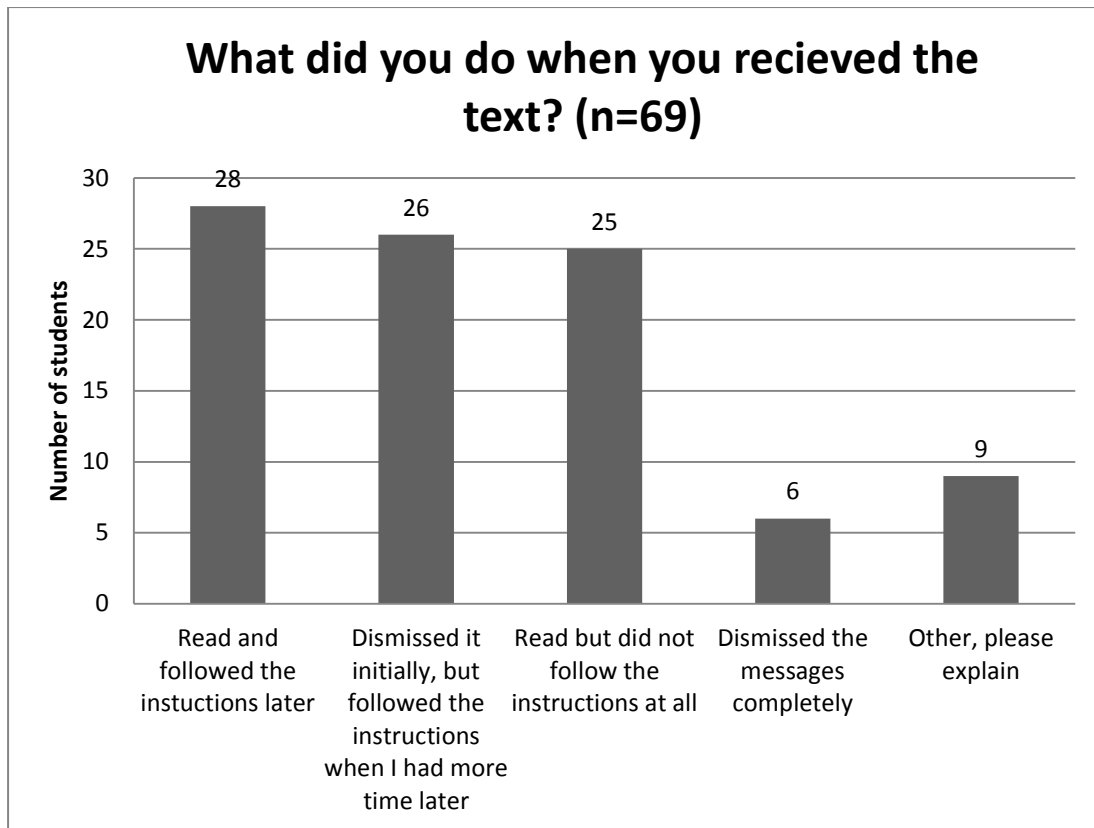


Figure 13: What the participants did when they received the text-messages?

As indicated by the following comment, participants made mental notes of instructions and planned to follow the instructions at a more convenient time. “I often forgot about the messages as I received them when I was busy but I do remember what they said and can use that later” (Zillinsky, student questionnaire).

Students planned to follow the instructions at a later time when they could apply the strategies more effectively. This student commented that she had saved the messages and would apply them when she was studying for her final exams. “I plan to implement the text strategies in the near future” (Marry, student questionnaire).

In summary, the participants indicated that they do read and follow the text messages they receive. Although some text messages tended to be received when participants were not able to follow the instructions immediately, they were able to get back to the messages at a later more convenient time.

6.8.2.3 Did the participants refer back to the messages?

Even if participants were able to follow the instructions contained in the text messages right away, in order for the study skills development program to be most effective, it would be expected that participants refer to the text messages as and when needed. For example, when they sit down to study and look back at the text messages to get ideas about effective study strategies.

As shown in Figure 8, 74% of participants either referred back to the messages or sometimes referred back to the messages.

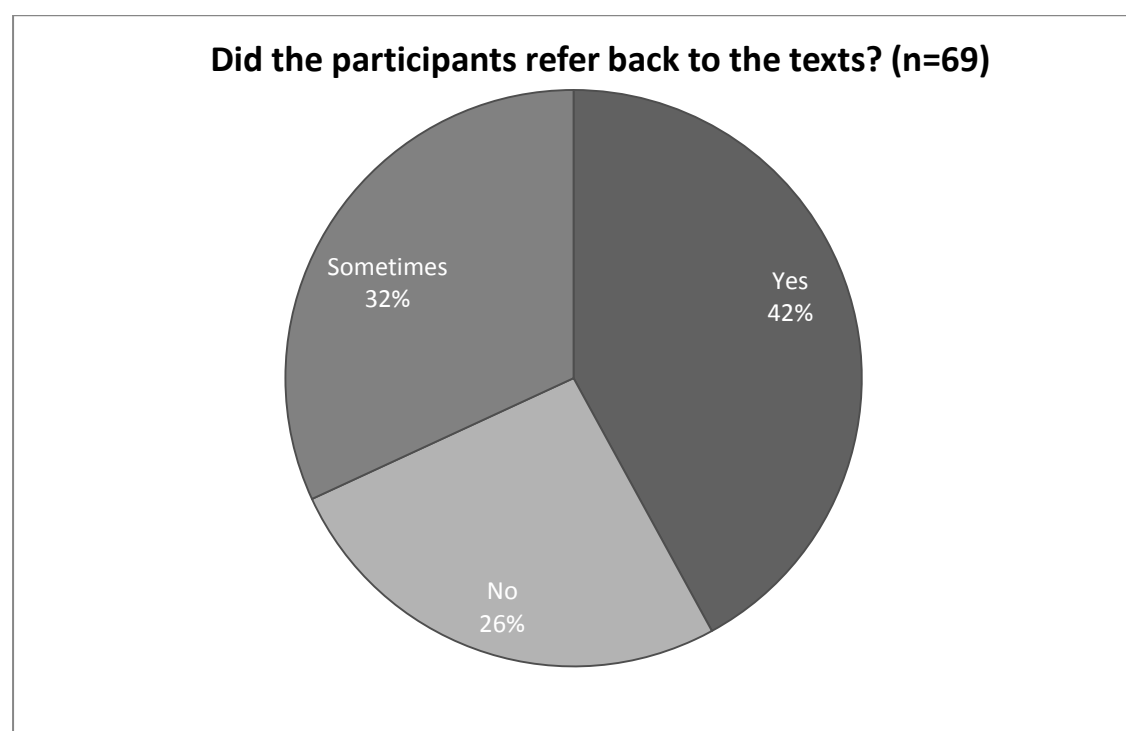


Figure 14: Did the participants refer back to the text messages?

Only twenty-six percent of participants did not refer back to the messages. These participants commented that often, when they read the messages, it was enough for them to understand and there was no need for them to go back again. For example, this comment suggests that a participant did not need to read the messages again to understand what she needed to do: “I had already remembered what they had said” (Rani, student questionnaire). Participants did find the messages useful and are more likely to go back and look at them again when they start preparing for their final

exams. It seemed that the messages were sent too early in the semester and would have been more useful if they were sent later on in the semester when participants are preparing for exams, as indicated by the following comment: “When the exam period approaches, I’ll do my best to implement the principles it told me” (Carly, student questionnaire). Some participants tend to forget about the messages if they arrive when they are busy with work or other activities. Thirty-two percent of participants sometimes referred back to the messages when they were making their study notes and needed more help. Often, these participants would think about the messages subconsciously as mentioned in the following comment:

In looking at that, I was like – thinking actually back on when I was in Year 11 and 12 – I did do some of those things, or I was thinking about, yes, when I actually get to the time when I’m going to study these subjects, I’m like yes, working on the harder subjects first is good. And yes, I was thinking about it, not actually currently was doing it. (Kelly, face-to-face interview)

Forty-two percent of participants read the messages again at a later time. They found the messages useful and therefore went back to them when they were studying or needed to refresh their memory. One participant commented during the interviews that:

Yeah, I took a mental note and then made time for the afternoon to do that sort of study and a different way of studying and stuff so one of them was make – link the, link the subjects together so I went back and looked through my notes and then realised they do like really link a lot together. (Cheryl, face-to-face interview)

In summary, the text message-based study skills support was effective as the participants referred back to the text messages when they realised they needed help with identifying and using appropriate study strategies. Similarly, the text messages became a useful reference for the participants to refer back to when they were engaged in studying for their final exams.

6.8.3 Participants profiles and reflections after participating in the study skills development program

Participants were requested to complete the post-study MSLQ as well as complete an end-of-study questionnaire and participate in a face-to-face interview. The post-study

MSLQ results were compared with the pre-study MSLQ results and a statistical significance test done to identify if the participants self-regulated learning skills improved. The questionnaire and face-to-face interview was used to enable participants to provide feedback related to their experiences about participating in this study skills development program.

In summary, the findings indicate that participants were able to improve their self-regulated learning skills by participating in the study skills development program used in this study. Analysis of the targeted skills compared to all the other skills for each student shows that the targeted skill improvement was much more than non-targeted skills. Participants also perceived that they were able to improve their skills as a result of their participation in the study skills development program. Overall, the participants report a positive experience receiving the text messages and suggest that similar study skills development program can be effective if offered to all university students.

These results are reported in detail below:

6.8.3.1 Comparison of Pre-activity and Post-activity scores

140 students volunteered to participate in this study and completed the pre-activity MSLQ. These students received the text message-based study skills support. However 69 students completed the final MSLQ and questionnaire, and therefore results of only the 69 participants who completed the post-study MSLQ is reported here.

Figure 9 gives a comparison of the average MSLQ scores across all the study skills categories between pre- and post-activity MSLQ. As can be seen from Figure 9, there was an improvement in the overall self-regulated learning skills of the participants.

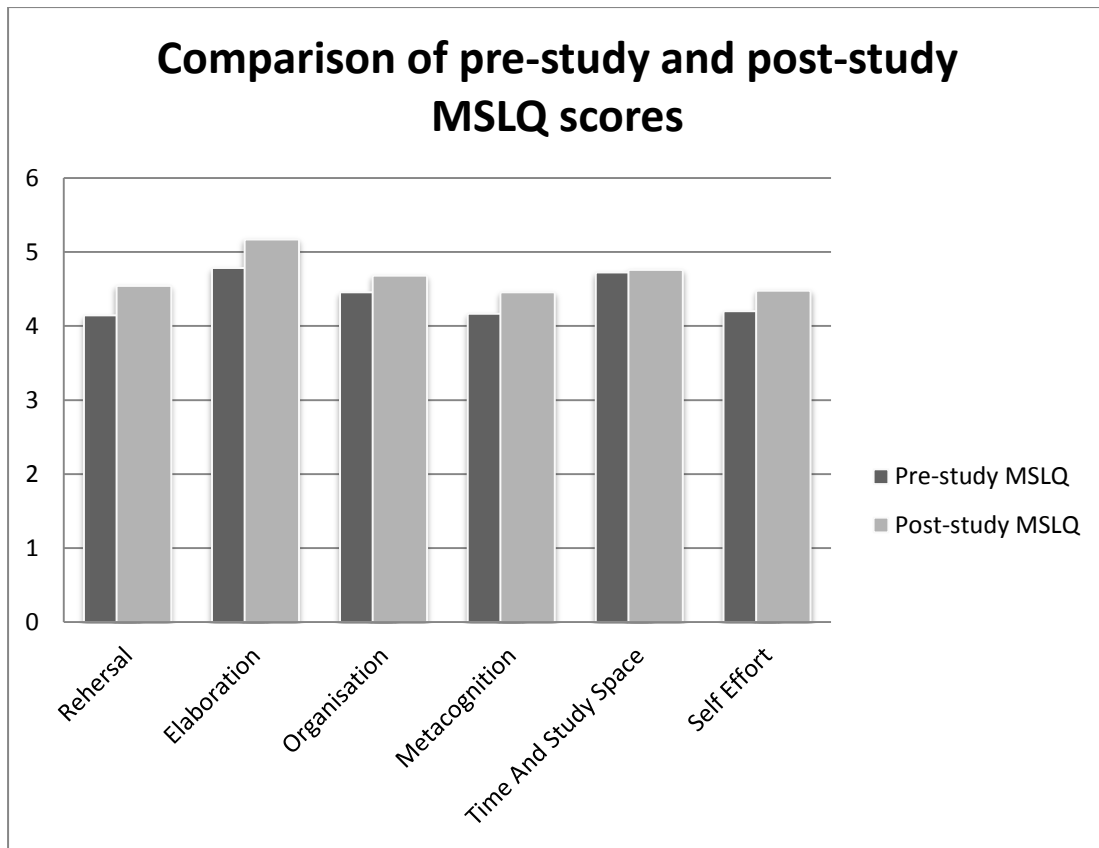


Figure 15: Comparison of pre-study and post-study MSLQ scores

In summary, the participants reported that by participation in the study skills development program, they were able to improve their cognitive learning strategies.

6.8.3.2 Change in MSLQ scores for each of the targeted cognitive learning strategies component

The overall averages of participants pre- and post-activity MSLQ scores shows improvements in participants' ability to indicate that their cognitive learning strategies had improved. Further analysis for improvement of each of the targeted cognitive learning strategies component indicates much more pronounced improvement in the targeted component compared to all the other skills. For example, participants who were targeted to improve their rehearsal component indicated that the percentage of improvement of their rehearsal component was comparatively more than each of the non-targeted components. Similar results were observed for all the other self-regulated learning components. A paired-samples t-test was conducted to compare the pre-study and post-study MSLQ scores for each of the targeted cognitive learning strategies components.

The table 9 below provides the results of the *t*-tests carried out on the pre-activity and post-activity MSLQ values. The complete set of graphs for all the targeted self-regulated learning skills components is presented in Appendix K.

Table 10: *t*-test values for each of the study skills targeted

	Pre- activity mean	Pre- activity SD	Post- activity mean	Post- activity SD	<i>t</i> (68)	p
Rehearsal	4.1	1.25	4.48	1.25	- 2.51	0.01 5
Elaboration	4.84	1.03	5.16	1.15	- 2.12	0.03 7
Metacognition	4.21	0.66	4.43	0.88	- 2.01	0.04 8
Organisation	4.38	1.08	4.66	1.15	- 1.68	0.09 8
Time and space management	4.86	0.79	4.78	0.92	0.77	0.44 2

The test shows that there was a significant difference in the pre-activity (M=4.1, SD=1.25) and post-activity (M=4.48, SD=1.25) scores; $t(68) = -2.51$, $p = 0.015$, for participants who were targeted to improve their rehearsal study skill component.

Similarly, there was a significant difference for participants who were targeted to improve their elaboration skills between pre-activity (M=4.81, SD=1.03) and post-activity (M=5.16, SD=1.15) score; $t(68) = -2.12$, $p = 0.037$.

The participants who were targeted to improve their metacognition skill also showed a significant improvement between pre-activity (M=4.21, SD=0.66) and post-activity (M=4.43, SD=0.88) scores; $t(68) = -2.01$, $p = 0.048$.

The difference in the pre-activity ($M=4.38$, $SD=1.08$) and post-activity ($M=4.66$, $SD=1.15$) scores; $t(68) = -1.68$, $p=0.098$), for participants who were targeted to improve their organisation skills shows that the difference was not statistically significant.

The participants who were targeted to improve their time and study space management skill also showed a statistically insignificant improvement between pre-activity ($M=4.86$, $SD=0.0.79$) and post-activity ($M=4.78$, $SD=0.92$) scores; $t(68) = 0.77$, $p=0.442$.

In sum, the improvement of participants' pre-activity and post-activity MSLQ score shows that elaboration, rehearsal and metacognition self-regulated learning skill were statistically significant, whereas the improvement of organisation and time and space management self-regulated learning skills were not statistically significant.

6.8.3.3 Participants' experience of receiving text messages

The pre- and post-activity MSLQ scores and analyses indicate that the study was successful in improving most students' rehearsal, elaboration, metacognition and organisation components of self-regulated learning skills, however, it is just as important to ascertain whether the students were able to engage with the activities sent via SMSs and if their experience was a pleasant one. As can be seen from Figure 15, eighty-one percent of participants (57 participants) who completed the end of study questionnaire indicated that their experience receiving the text messages as part of this study was either 'good' or 'excellent'.

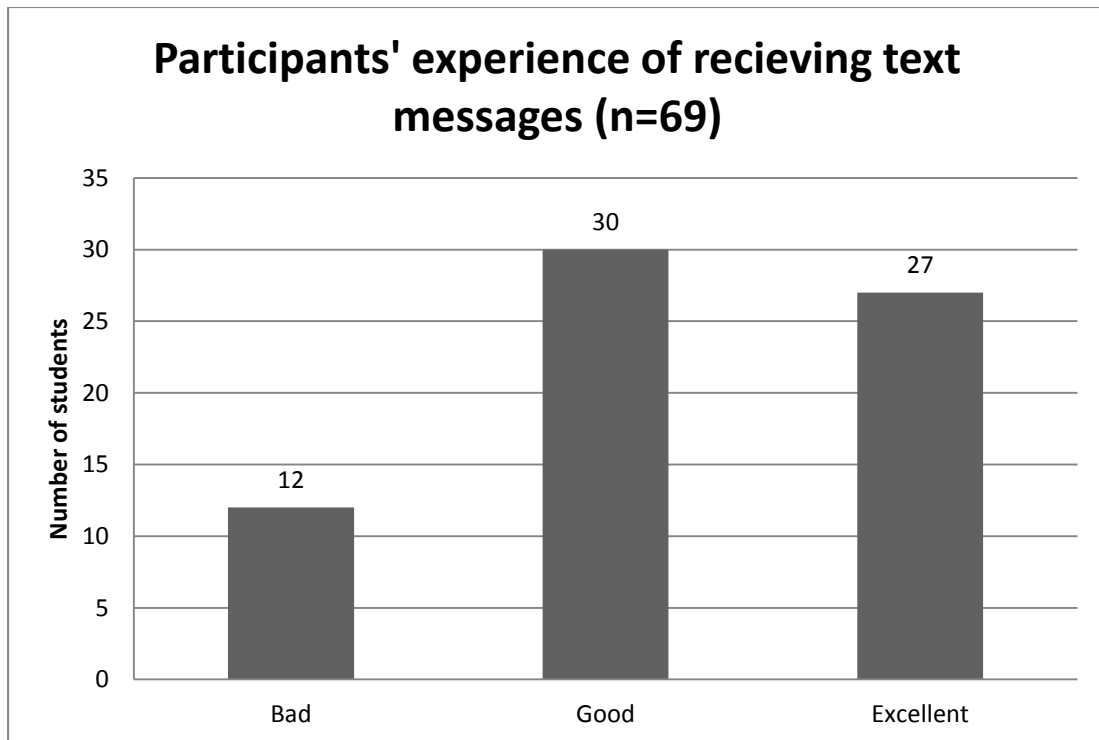


Figure 16: Participants' experience of receiving text messages

These participants liked the text messages as it encouraged them to think about studying and they found the tips useful. Because of the text messages, participants could return to the messages when it was more convenient for them. They also indicated that the messages were useful for obtaining "small bite-sized" tips. These comments in the student questionnaire highlight the sentiments of students who found the experience 'good' or 'excellent':

Motivated me and made me think about doing study when I was out doing other things. (Devlin, student questionnaire)

They helped me focus on different study strategies and worked as a reminder to study. (Brent, student questionnaire)

Twelve participants (17%) indicated that they had a bad experience receiving the text messages as part of this study. They reported that the messages were "common sense" (Tom, student questionnaire) and that some of them already knew how to study. The messages, however, did make some participants feel 'guilty' about not studying even if they did not follow the messages. Some of these participants also felt that the messages arrived when they were busy doing other things. For example, this comment suggests that the participant did not follow the messages as he had his own way of

studying: “I did not really consider the information because I already have a set way of doing things” (John, student questionnaire). Even though some participants did not find the experience useful, as indicated by the following comment, they did find the messages worthwhile and would probably attend to the messages at a later time: “It was at inconvenient times but because it can be saved I might look at it later” (Zillinsky, student questionnaire) .

In summary, over eighty percent of participants indicated that they had and overall good or excellent experience receiving the study skills development support via text messages. Although 17% of the participants indicated that they had bad experience, some of these participants went on to also state that they are likely to come back to the text messages at a later time when it is more convenient for them.

6.8.3.4 Participants’ perceptions about whether the text messages helped them improve their study skills

Participants’ perceptions about if they thought that the text messages were useful is an important indicator of effectiveness of the strategies. Participants were asked if they thought that the text messages helped them improve their study skills. Figure 16 represents participants’ responses to this question in the questionnaire.

**% of participants perception about whether
the texts helped improve their study skills
(n=69)**

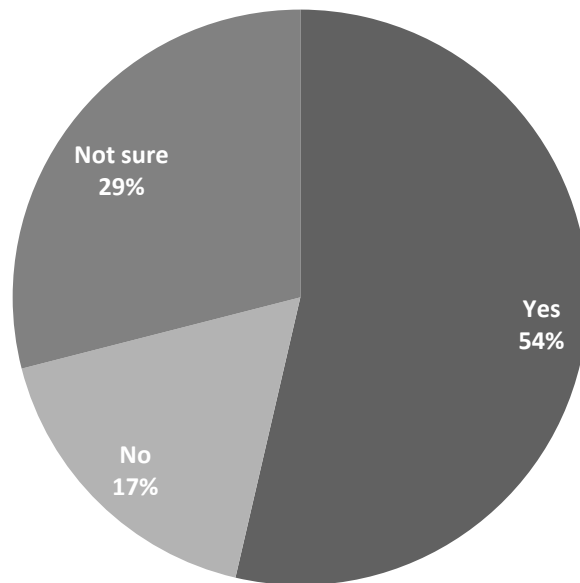


Figure 17: Participants' perception about whether the text messages helped improve their study skills

Fifty-four percent of participants indicated that they thought the text messages were helpful for their studies. "It gave direction when I had no idea" (Sarah, student questionnaire) and helped with new ideas when they had no idea about how to study. Participants also thought that the messages contained "helpful tips" (Tanabe, student questionnaire). The convenience of providing these study helps via mobile phone was highlighted by the following comment: "yes because I was able to take the message wherever I went" (Cheryl, student questionnaire). Similar sentiments were echoed by participants in the face-to-face interviews:

I'd read through them when I got them and look back at them after because sometimes I wasn't awake, like even at 10.30 so I'd see it and then I'd be like, 'oh I'm going back to sleep' and stuff and I'd look back, refer back to it later and, yeah, I found them useful, they were useful. I think like, maybe it was just me, like I didn't put them into practice right then, probably because I

hadn't really gotten into studying yet but I've started to look back at them and kind of use them to direct me, what I should be doing with my study. (Arti, face-to-face interview)

Participants are also able to engage with thinking about appropriate study behaviours even though they are unable to follow the instructions right away:

What I was able to do, is looking at that, I was like – thinking actually back on when I was in Year 11 and 12 – I did do some of those things, or I was thinking about, yes, when I actually get to the time when I'm going to study these subjects, I'm like yes, working on the harder subjects first is good. And yes, I was thinking about it, not actually currently was doing it, but like briefly thought. (Kelly face-to-face interview)

Another participant, Peta, commented during the interview that the text messages were helpful:

Yes and the language, because I've been focusing on language because it's one of our subjects, the language was really accessible, it was nice and it didn't feel like I was being told what to do. So again, and I said, "Oh who is this ... text ... from?" and you know, it was engaging and I always read them and I never deleted any of them, like they're all still on the phone so. (Peta, face-to-face interview)

Twenty-nine percent of participants responded that they were not sure if the text messages helped them in their studies. They reported that they did manage to follow some of the messages, and that they learned new ways of studying, although they have not been able to put these into practice. "I think it inadvertently helped with my study, not so much the substance of the text but the good reminder it served" (Matt, student questionnaire). Overall, participants did find the messages useful; however, they commented that they were not sure if the messages helped improved their study skills as they did not implement the recommended strategies. "I didn't really implement what was said. I just took it on board when studying. Didn't change the fundamental aspects of my study I just considered them" (Jenna, student questionnaire).

Seventeen percent of the students indicated that the text messages did not help them with their studies. Some reasons given were that the messages were received when it was inconvenient for them to follow them, “I didn't follow the suggestions in the messages, as the messages often came when I was not studying” (Cathy, student questionnaire), but they also indicate that they wished to follow the instructions when they start studying. Some participants commented that although they did not follow the instructions, they were able to get motivated to study using their own study methods. Some participants regarded the messages as just extra work that they had to do and did not attempt to do the strategies suggested in the text messages: “I was so busy with assignments that I had very little time to study and use the SMS tips” (Marry, student questionnaire).

In summary, participants’ perceptions are important indicators about the effectiveness of the study skills development program. The participants indicated that the improvements in the self-regulated learning skills were as a result of their participation in the study skills development program.

6.8.3.5 Should this type of text message-based support be included for all university subjects?

During the face-to-face interviews participants were asked if this type of study support should be included for all university subjects. All the participants who participated in the interviews can see the benefit of this type of support for all university students. They feel that all students can benefit from these strategies, particularly since the messages were customised and targeted for each students’ individual study needs. For example:

I generally think it’s an awesome concept to be able to see the study skills that you work on and to be able to have tools and information and how to study. I think that, like I’ve been studying for a while and it’s generally and even at high school and junior school it’s something that you’re always struggling with, how to study better and no one can kind of help you or give you answers or anything so I just think, ‘Oh I’ll just try it and work it out yourself’, and if that doesn’t work so I just found it really helpful to know that even with the survey and the SMSs to work out the areas that I could improve on that’s how it helped, I found that really helpful and it’s something that’s never been addressed before in any

of my studies so I think it's a really useful tool, I thoroughly recommend it, with the research obviously. (Heicki, face-to-face interview)

This comment from another participant during the interview also suggests that the SMS-based study support can be useful across other subjects and disciplines in university courses:

Good, I never thought, I never thought of it like that idea existing, like someone sending messages to help you study, it's kind of two different worlds sort of, kind of like someone that reminds you to study, messaging kind of thing, it distracts you from study and you know. But it seems to be effective in a way not, like in I didn't – I had done it straight away. I think it'd be good for harder courses and stuff where you have to stay on top of everything so like a friend's doing the Environmental Science and he struggles, he has a stack to read every day to keep up, something like I guess in Medical Science or something just to be like, give them kind of prompts and to give them a little bit of motivation yeah. (Sherine, face-to-face interview)

One participant indicated that she received similar help in high school through a seminar, but it was very generic. She feels that since the text messages in this study were more targeted and customised they were more effective:

Yes, the SMSs were probably more targeted to me and more a narrow kind of idea for studying, whereas this lady had to cater to 500 people. She'd give a seminar – like, so it was every second Thursday or Tuesday or something, and every second one of them, it would be a lady coming in and giving an assembly to 500 of us – our year – so she obviously had to be very broad and say – “this might work for some of you, this might...” – so it wasn't very – but they were good ideas, but a lot of them didn't relate to me, because I like doing things like reading out loud and things like that, whereas other people just like to do practice tests. (Toni, face-to-face interview)

In summary, the participants indicated that because they found the text messages helpful, they can see it being of benefit to all students at the university.

6.9 Discussion

The ability of first year university students to develop and apply effective self-regulated learning skills is linked to better academic performance and lower attrition rates (Torrano & Torres, 2004; Zimmerman, et al., 1992). This study was aimed to help First Year University students develop their self-regulated learning skills by providing relevant support using text messages sent to students' mobile phones. This study is particularly important since the majority of first year university students, due to their previous study backgrounds, are not effectively prepared for independent study. This study is timely since universities are increasingly encouraged to reduce their dependence on public funding, attract students from low-socio economic backgrounds and attempt to reduce overall attrition rates.

The specific research question used to frame the design, implementation, data collection and analysis was: "How can first year university students be supported to develop their independent study skills using mobile phone technology?"

In order to answer this research question, a study skills development program was designed and implemented. This program was designed to identify students individual self-regulated learning needs and then send relevant, individually targeted support using text messages to their mobile phones at different times of the day. The text messages contained instructions to help students develop their self-regulated learning skills. This study skills development program was informed by the MSLQ questionnaire and manual for self-regulated learning skills which is based on the self-regulated learning theory (Pintrich, et al., 1991).

Data was collected using the online version of the MSLQ. Participants completed this MSLQ before the start of the study skills development program, as well as once again at the end of this study. The responses to this pre-activity MSLQ was used to identify individual self-regulated learning skills needed for each student, and then send relevant SMSs targeted to help individual participants improve their weakest skill. The pre-activity and post-activity MSLQ scores were used to get a quick comparison to identify if the participants reported any improvement in their self-regulated

learning skills. Participants also completed an online end-of-study feedback questionnaire and a subset of participants took part in the face-to-face interview.

The findings of this study indicate that mobile phone technologies can be effective to help first year university students develop essential self-regulated learning skills. Although self-regulated learning has been developed using various implementations of mobile learning by a number of previous studies (Gurtner, et al., 2011; Kovachev, et al., 2011; Shih, et al., 2005), this study is different as it successfully identified students individual self-regulated learning skills need and provided individualised support via cost-effective, ubiquitous SMSs sent to students mobile phones. The findings of this study is also significant as it addresses calls for individualisation of learning support as a result of increasing diversity in student learning styles (Laurillard, 2002).

6.9.1 University studies is challenging for first year students

The increasing diversity of student populations in universities poses significant challenges for educators to address the varying learning needs and styles. Although a small majority of participants in this study came to university directly from high school, a number of participants had some work experience and some even have had post-secondary studies other than university. The participants in this study used the learning skills and habits that they had used in previous study environments like high school, post-high school institutions, home schooling or overseas institutions. Transitioning to a new learning environment can be difficult for most first year university students and therefore students continue to use all the learnings skills and habits that they have used in the past (Schunk & Zimmerman, 1998).

Universities expect students to be independent learners, with the ability to manage their own learning according to expected outcomes. Students' ability to develop these independent study skills greatly determines their success or otherwise at university (Nisbet, 1991). Although some students will develop these independent study skills on their own, others will need explicit help with it (Cleary & Platten, 2013;

Zimmerman, et al., 1992). Studies have shown that with effective training it is possible to develop these independent study skills through “direct teaching, modelling, guided and independent practice, feedback, self-observation and social support” (Torrano & Torres, 2004, p. 17). Given the importance of independent learning skills for university students, development of these skills cannot be left to chance, every effort must be made to ensure appropriate and relevant support is provided to students to help them develop these skills as quickly and efficiently as possible.

The participants indicated that they find university studies challenging and often struggle to study what is being taught, focusing on completing assessment tasks rather than studying. Most participants in this study indicated that they do not employ any strategic study techniques, but rather use what seems to have worked for them during their previous study environments like high schools, in most cases employing strategies involving reading and re-reading lecture notes and text books. It was evident from this study that most of the participants in this study do not apply effective and proven study strategies.

The participants also indicated that they have very busy extra-curricular commitments, for example sports, carer responsibilities and the like. These students indicate that because of their busy ‘after-university’ schedules, they try to fit in studies whenever, and wherever they can, often spending very short amount of time on studies before moving on to other activities. The findings of this study indicate that participants’ study patterns tend to be very ad-hoc and based on their convenience. The times and spaces that is convenient for studying differs between students. Universities will find it increasingly difficult to address this diversity of learning needs and styles and will need to take advantage of opportunities provided by technologies to create more individualised learning support (Laurillard, 2002).

The participants in this study indicated that although they use their mobile phones extensively, it was the least used technology for supporting their learning. It was also evident from the participants in this study that although modern mobile phones today

contain extensive applications like email, social media and games among numerous other things, text messages were the most used application.

6.9.2 Mobile learning is a suitable medium to connect with students outside of class time

Compared to other forms of electronic communication like email, social media and the like, text messages can be extremely effective in gaining attention (Hjorth, 2005). The participants in this study confirmed this by indicating that the text messages were successful to catch their attention regardless of what they were doing. The text messages forced participants to at least look at their phones even when they were engaged in activities like work or caring for children, even if they were unable to follow the instructions right away. If their situation permitted, the participants followed the instructions contained in the text messages and applied the study strategies. In cases when participants were unable to apply the strategies right away, they indicated that they would make a mental note about it and come back to the text messages when it is more convenient for them to do so. The participants further indicated that for this reason in particular they preferred to receive the study support via text messages as opposed to email or other social media messaging as the text messages were always available regardless of the quality of mobile Internet coverage and they did not have to log-in to another system to access the study instructions.

In situations when participants were unable to follow the instructions, a number of them indicated that they would make a mental note of the text messages to get back to later, but if they were able to read the message they would often think about the instructions while they continued with other activities like working. Reflective study practices enable students to think about their current study practices and identify strategies they can apply in order to improve how they study (Schon, 1987).

Universities need to explore strategies that provide individualised teaching and learning support to address the diversity in learning needs and styles encountered as a result of increased student numbers and enrolments from non-traditional, straight out of high school students (Chang, Sheu, & Chan, 2003; Kukulska-Hulme, 2007;

Laurillard, 2002). Generic study supports, although convenient, may not act effective for all students, and may end up leaving some students behind.

The cognitive learning strategies of the self-regulated learning skills consist of six components: rehearsal, elaboration, organization, meta-cognition, time and space management and self-effort. Students usually demonstrate different levels of competencies in their ability to apply each of these components, for example some students may be very competent with rehearsal strategies but be extremely incompetent with organisation (Zimmerman, 2000). Different strategies exist to develop each of these self-regulated learning skills components. Effective strategies to enable students to develop these self-regulation learning skills must recognise these differences between students and address the skills most in need for each student.

This study used the Motivated Strategies Learning Questionnaire (MSLQ) to identify the cognitive learning strategies of self-regulated learning skills component that each student needed most help with (Pintrich, et al., 1991). This was the component in which the student was weakest. Text messages, containing the strategies to improve the weakest components, were then sent to each student. This enabled the text messages to be individually targeted according to each student's need.

The results show that the participants were able to, through the pre-study and post-study MSLQ, as well as the questionnaires and interviews, improve their overall self-regulated learning skills. While the overall self-regulated learning skills improved for the participants, the improvement observed for the targeted component of self-regulated learning was comparatively higher than the other components. Although not all the improvements were statistically significant, the results are still positive. These findings confirm studies that discuss that although some students can develop self-regulated learning skills by participating in the various learning activities as part of their enrolment in university subjects, most need explicit support to develop these skills (Torrano & Torres, 2004).

Although it may be possible for students to improve their self-regulation learning skills as part of going through the university study processes, the participants in this

study felt that the improvements in their self-regulated learning skills were more likely due to the SMS prompts. The *t*-test of the MSLQ results also indicated that the improvement in the targeted study skills component was more than all the other study skills components. (For a complete results of the *t*-test refer to Section 6.8) The participants in this study also indicated that they appreciated the fact that the supports were individually targeted and felt connected to them.

The results of this study are encouraging; all students who participated in the study were able to improve their self-regulated learning skills, even though the improvements varied between students. It was not possible to identify from this study the reasons some participants were able to improve their skills more than others. In any case, all participants were able to increase their awareness about effective study strategies.

It is important however, to acknowledge limitations of this study, as certain aspects may have affected the findings and interpretations of the data. This study was done with a cohort of first year Bachelor of Education students who were enrolled in an introductory educational technology course. These students had an implicit interest to observe and understand novel implementations of educational technology. This might have influenced the way in which these students engaged with the study skills development program. Although the findings with this cohort indicate positive results, it cannot be generalised that similar findings will be observed with students from other faculties of the university. This study showed that by identifying and targeting individual study skills using text message, it was possible to help participants improve their overall study skills. However, it should be noted that this study was conducted with a cohort of students who were inherently interested in implementations of educational technology which is likely to have influenced their participation in this study. Even then the findings are considered positive and indicates that mobile phone technologies can be effectively utilised to enable provide study support to first year university students.

Unfortunately this study was unable to identify any participant who needed support to develop their 'self-effort' component of the self-regulated learning skills. It is unlikely that no student in the whole cohort of students enrolled in the subject used in this study. Self-effort component relates to the ability of students to apply themselves in challenging situations. It can only be speculated the students who needed help to develop their self-effort were unable to apply themselves to participate in this study. This study then addresses all components of the self-regulated learning skills except the self-effort component.

For future research and implementations, effort must be made to engage all students to participate, perhaps by integrating this study skills development program with an assessment task. This would ensure all students are able to benefit from the program, rather than only the students whose self-effort skills are higher. The statistical significance tests showed that cognitive learning strategies of the self-regulated learning skills improvement was significant for participants who were targeted to improve their rehearsal, elaboration and metacognition, and although organisation, and time and space management also improved, these improvements were not significant. Future research in this area will be well placed to explore the processes that lead to significant improvements and suggest appropriate strategies to make development of self-regulation skills more effective

With developments in mobile phone and smartphone technologies, particularly with 'apps' technologies, future implementation will benefit from development of apps that incorporate the online version of the MSLQ used in this study. This would allow students to be able to use their phones to identify and receive the text message supports without the need to necessarily engage faculty to provide the support.

6.10 Conclusion

This study was aimed at helping first year university students develop their self-regulated learning skills. A study skills development program was created that used MSLQ to identify students' individual study skills need and then sent them a number of relevant text messages with instructions to improve their study skills. The findings indicate that mobile phone technologies are effective in engaging students through

individualised study program to improve their individual study skills. This study was implemented with a cohort of first year Bachelor of Education students, the positive findings of this study may not necessarily apply to students from other faculties. Future research should also aim to identify opportunities for closer integration of similar study skills development program with students' assessment task.

6.11 References

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7 INVESTIGATING STUDENTS' EXPERIENCES WITH MOBILE LEARNING

*Prepared for submission for review as: Anand, P., Agostinho, S., Bennett, S.,
Investigating students' experiences with mobile learning.*

7.1 Abstract

Universities are recognising the opportunities of using mobile learning to increase students' access to teaching and learning resources both inside and outside the class. Expecting students to use their mobile phones to access and/or interact with teaching and learning resources while they are inside the class may be tolerable as students are within allocated learning times and spaces, however the reactions of students when they get interrupted by mobile learning during their personal times and spaces is not clearly understood.

This study investigated students' experiences with mobile learning during their personal time outside of university classes. A case study approach was used to study the mobile learning experiences of 69 first year Bachelor of Education students at the University of Wollongong. The mobile learning activity identified students' individual self-regulated learning skills needs and then sent a number of customised, targeted text message prompts to students' mobile phones between 7.30am and 10.30pm (including weekends) over a six week period. The messages were designed to help students improve their self-regulated learning skills. A post-study questionnaire of all participants and a post-study face-to-face interview with 11 participants collected data about students' experiences of mobile learning used in this study. The overall findings suggest that the participants were generally receptive to the study-related text messages during their personal time. The participants were able to follow the study skills instructions provided by text messages and that the messages influenced them to engage in positive study practices. The findings also suggest that although the text message based study support may not be suitable for all students, it is an important strategy to explore within a mix of support strategies to engage and support first year university students.

7.2 Introduction

A number of studies have explored supporting learning outside the classroom using mobile technologies (Colella, et al., 1998; Rogers et al., 2002; Winters, 2007; Yee & Park, 2005). These studies were successful in demonstrating the potential of mobile learning, but required significant proprietary infrastructure, resulting in comparatively costly implementations which were difficult to transfer to other settings. They were, however, instrumental in stimulating discussion about effective implementations and appropriate pedagogies of mobile learning. More recently, mobile learning studies have begun to explore more generic and inexpensive implementations of mobile learning which can be applied across a wider range of settings (Jones, et al., 2009; Ismail, Johari, & Idrus, 2009; Kervin, 2005). These studies show the potential of mobile learning to enable a university faculty to engage with students (and vice versa), with immediacy and convenience, allowing students to obtain support and access to learning resources as and when they need.

The implementation of any new technology in education must always consider the impact on student's experiences of learning (Naismith, et al., 2004). Recently, mobile learning researchers have begun to explore ways to engage students in learning activities during their personal time, as well as in class (Andrews, et al., 2010; Ros i Solé, et al., 2010). Because students tend to 'switch off' from study when they are outside class or when not actively working on assessments, engaging them during this 'informal' time is thought to provide continuity of learning between formal learning environments (such as lectures, tutorials or practical classes) and informal environments (such as home, social and work settings). For example mobile blogging has been used to encourage students to upload content and reflections, while they are out and about, related to their inside class topics and discussions (Comas-Quinn, et al., 2009). Similarly, another study used mobile instant messaging to facilitate students to provide peer support when students were working on their subject related activities outside class (Timmis, 2012). Some other studies have also used mobile games to encourage students to interact with learning materials (Kondo, et al., 2012). Most other studies have similarly used mobile learning to get students to engage with learning content that is covered in the subject students are enrolled in (Abdullah, et al., 2013; Kovachev, et al., 2011). These studies indicate the opportunities to engage

students during their outside class times however, the studies are unable to report the experiences of students when they are expected to engage in mobile learning when they are in their informal times and spaces.

Informal learning is generally defined as learning that occurs when students are not located in their physical study locations (Rapetti, et al., 2011). Formal learning is generally considered to be learning that occurs inside a designated learning space at a designated time, such as a classroom or lecture theatre. Although these definitions of formal and informal learning are useful, they do not effectively address the full spectrum of formal and informal learning. Students often acquire unintended skills and knowledge while participating in learning activities that were explicitly designed and delivered inside a classroom. For example, students frequently participate in group work and discussions that are designed with explicit objectives; however, they also unintentionally acquire skills such as inter-cultural communications. The group-learning activities in this example are considered formal learning; however the group work also enables students to engage with informal learning where other skills are acquired. Similarly, when students participate in learning activities outside the classroom it is considered informal learning; however, it can be argued that if the learning activities are explicitly designed according to the expected outcomes of a course or subject, the learning is in fact formal, as students are not learning anything that is unintended. Based on these two examples, then, there are two dimensions of formal and informal learning. Every learning activity can be classified according to *intent* and *structure* dimensions of formal and informal learning, and placed on a continuum of formal and informal learning for each dimension. In this context structure refers to the physical environment where learning occurs; a formal structure indicates learning inside classrooms and lecture theatres, whereas an informal structure suggests learning outside formal physical structures. Intent refers to how the learning activity is designed to meet stated course objectives; a formal intent suggests that the learning activities are explicitly designed to enable students to meet stated objectives, whereas an informal intent suggests that students have the freedom to choose what and how they learn (Sefton-Green, 2004).

For example, a learning activity where students take their mobile phones outside the classroom to take pictures of artefacts that support what they are learning in class can be considered informal, in terms of the structure dimension, but formal in terms of intent (Comas-Quinn, et al., 2009; Ros i Solé, et al., 2010). Similarly, learning activities where students work on unintentional activities inside the classroom can be classified as informal in terms of intent and formal in terms of structure.

Learning activities in themselves are not absolutely formal or informal, but rather tend to fit between formal and informal on a continuum. Different studies, however, have interpreted the concept of formal and informal learning quite differently. For example, some researchers believe informal learning can also occur within a formal classroom when students learn incidentally (Sefton-Green, 2004). Further, personal study done by individual students in their own time, in student-initiated peer support groups and as part of collaborative assignment work outside of class does not fit neatly into the formal/informal distinction. This has led to the suggestion that formal and informal learning are better placed at either end of a continuum, allowing that learning may be neither completely formal nor completely informal (Timmis, 2012). While this solution provides greater subtlety, it renders the terms themselves problematic to use. It is necessary, therefore, for authors to clearly explain how they define formal and informal whenever the terms are used.

This paper presents the findings of a study in which customised study-related text messages were sent to students' mobile phones to support them develop appropriate study skills. The timing of the messages was such that the program deliberately sought to engage students outside scheduled class time, and so engage students in what we consider 'informal learning' for the purposes of this project. This paper reports findings that give insights into the nature of students' experiences when this approach is used. The following sections outline the research methodology, data collection and analysis, results and discussion of key findings.

7.3 Methodology

This study sought to address the over-arching research question: *“How does using mobile phone technology influence how first year university students engage in learning outside class?”*

Attempting to learn about students' formal and informal mobile learning experiences is a complex and relatively unexplored phenomena, even though a number of studies have used mobile learning in students' informal learning spaces. Students' experiences of being interrupted by study-related text messages when they are engaged in non-study activities require careful evaluation, especially since individual family, social, work and leisure lives are likely to vary significantly. While text messages may seem like a convenient and flexible way to engage students outside class, it cannot be assumed that all individuals will experience this approach as motivating and engaging.

A case study approach was deemed as a suitable methodology for this study. Case studies enable researchers to collect detailed data about participants in complex naturalistic settings (Yin, 1993). This was an exploratory case study that aimed to advance understanding about the ways in which students interact and respond to mobile learning activities outside class time. As part of the case study, qualitative and quantitative data were collected to inform about the impact on and experiences of students receiving study-related messages via their mobile phones that potentially interrupt their personal time and space.

The study was conducted with first year Bachelor of Education students at the University of Wollongong who had been invited to engage in an optional self-regulated learning skills development program implemented using mobile technology. First year at university can be a particularly challenging experience for students, as they make the transition from high school to higher education. University students are expected to operate as independent learners, and first year at university is a critical time for students to develop their skills in self-regulated learning. This self-regulated learning skills development program was offered to all students as an adjunct to a compulsory subject introducing them to educational technology. The use of mobile phone technology allowed students to be sent text messages related to particular aspects of the cognitive learning strategies of self-regulated learning skills identified to suit their individual needs.

The study was approved by the University of Wollongong's Human Research Ethics Committee (UOW HREC approval number HE08/315, see Appendix A). Students were informed about the research by the researcher during their first lecture in the subject. The researcher then visited the tutorial classes to answer students' questions about the proposed study and to distribute participation information sheets and consent forms (see Appendix B for the participation information sheets and consent forms). All participation was voluntary and students were advised that they could opt out at any time and were not obliged to complete any or all of the data collection methods used in this study.

At the beginning of the study each participant completed the cognitive learning strategies sub-scales of the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich et al (1991) for identifying and promoting the development of essential learning strategies associated with self-regulated learning skills (see Appendix F for the MSLQ items completed for this study). The MSLQ scores were used to identify participant's individual competencies against each of the cognitive learning strategies components. The component for which they received the lowest score was then chosen as the topic for future text messages. This pre-study MSLQ score was also used as a base-line measure of participants' self-regulated learning competencies.

The participants were sent eight text messages over a period of 6 weeks, between 7.30am and 10.30pm (including weekends). The content of the text messages were based on the guidelines for effective study available in the MSLQ manual (Pintrich, et al., 1991), and related to the specific study skills need that had been identified using the pre-study MSLQ for each participant. The text messages were sent in two sets, for example, the first set of text messages for the identified elaboration study skill, participants received the following text messages:

- a. Paraphrase and summarise important information from your lecture
- b. Use your own words to describe material covered during lecture/readings
- c. Try to figure out how each topic relates to the other

d. What are the connections between the topics

These text messages were reworded and sent again, as a second set text messages. (See Appendix J for the full details of the text messages sent.³)

At the end of the six-week period, participants were asked to complete the MSLQ questionnaire once again. This post-study MSLQ score was used to compare participant's self-regulated learning skills with their pre-study scores to evaluate the effectiveness of the program. These results are reported in detail elsewhere (see Chapter Six of this thesis⁴).

Students were also asked to complete a questionnaire about their study habits over the period of the study, their experiences of mobile learning approach used and the effectiveness of the program (see Appendix G for the full text of the questionnaire). Volunteers were sought to participate in an individual face-to-face semi-structured interview at the end of the study. The interview aimed to collect information from students on questions similar to the questionnaire, but designed to elicit rich descriptions about students' participation and experiences with the mobile learning approach used this study (see Appendix H for the interview protocol used). The interviews were audio-recorded with the permission of participants and transcribed for analysis.

140 students volunteered to participate in the study and completed the pre-study MSLQ. After 6 weeks 69 participants completed the post-study MSLQ and the post-study questionnaire. 11 participants out of the 69 who complete the questionnaire were also interviewed. The post-study questionnaire collected both qualitative and quantitative data which were initially analysed by doing a frequencies analysis on all the quantitative data to identify overall patterns, this was followed by descriptive analysis of the qualitative data to further inform the patterns identified through the quantitative data. The interviews were used to provide more information about the data collected from the questionnaires, and gave the participants an opportunity to add

³ These additional details have been included for the thesis version of this paper, but will not be included in the version of this paper submitted to a journal. A reference to the unpublished thesis will be included instead to allow interested readers to consult the full detail.)

⁴ This will be updated when this manuscript is published to reflect the publication of Chapter Six.

personal perspectives about how they responded to the activity. The answers to questions were interpreted by the researcher and themed summaries were provided next to each question. All the interviewees' answers were then compiled onto a single table and further summaries were provided, identifying the themes for each question from all the interviewees.

7.4 Results

The following results are derived from an analysis of the post-study student questionnaire and face-to-face interviews. The results provide insights into participants' usual study habits prior to this study, the impact of study-related text messages on participants' social, work and other non-university commitments, and their experiences of receiving study-related text messages outside of class time. Direct quotations are included to provide further insights in participants' own words.

7.4.1 Participants' study profiles

Using the post-study questionnaire and the face-to-face interview, participants were asked about their usual study habits, which involved seeking information about the times when they normally study, the locations where they study and their preferred study mode that is, if they prefer to study with peers or individually. This participants' study profile provided information about the way in which participants normally study, and to gauge the suitability of text message-based study skills support.

Participants indicated that they spend considerable amount of time in outside class learning activities like working on assessments or personal study. Some of the personal study activities that the participants undertake range from developing a deeper understanding of the various topics covered in class to organising their work study schedules. The amount of time spent studying outside class will differ between participants and across the semester according to varying workloads and timing of assessments and exams. Participants will also study at different times of the day to suit their lifestyle, commitments and preferences.

When asked about when they preferred to study, 67% of the participants indicated that they preferred to study on weeknights. For this question, participants were able to choose more than one preferred times. As can be seen from Figure 1, the most

preferred time of weeknights is closely followed by weekdays (62%), weekend day time (55%) and weekend nights (23%).

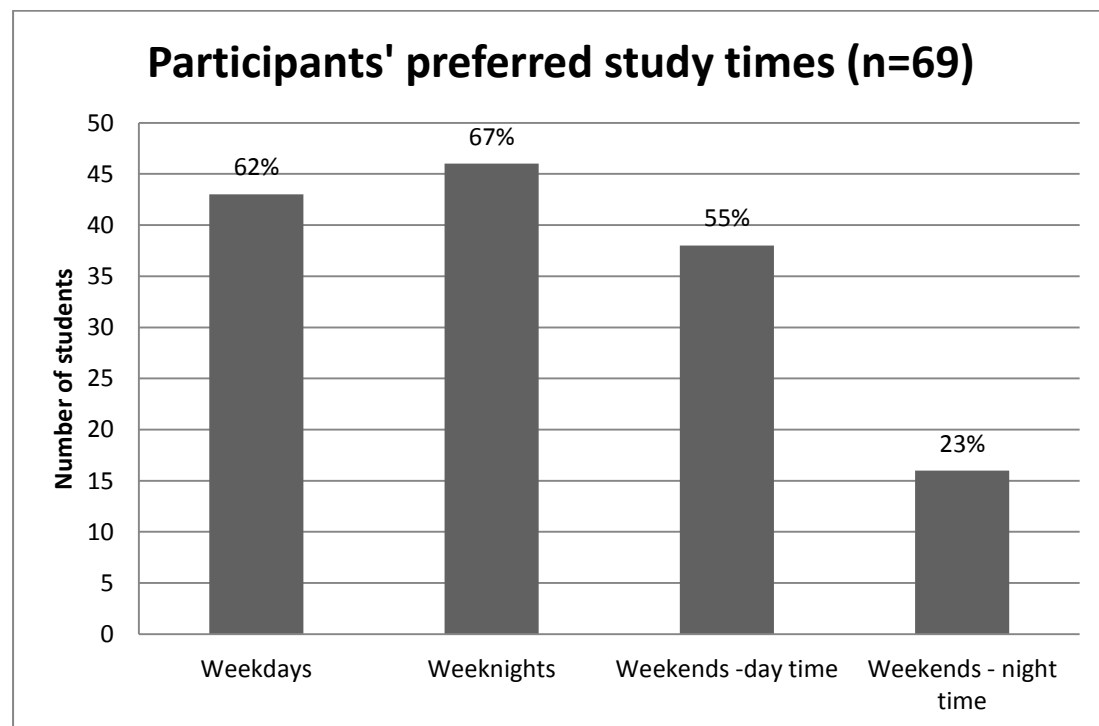


Figure 18: Participants' preferred study times

A typical response was, "whenever I have time, as time is limited" (Ron, student questionnaire). Another participant commented, "I study whenever possible as I am very busy. I would prefer to have weekends to myself, but this is not possible at the moment" (Belinda, student questionnaire).

Participants who indicated that they study exclusively during the weekdays or weeknights or even those who studied on weekends did so because of various other commitments and responsibilities, like "I am often busy on weekends, particularly at night. Weeknights I tend to be quite tired" (Marry, student questionnaire). Another student offered:

Students generally tend to have a lot of responsibilities and commitments:
I have a number of activities during the week such as tutoring 5 children, teaching dancing classes 3 times a week and leading at my youth group and attending church. I work better during the day and in the mornings but if I have to will stay up late to get it done. (Zillinsky, student questionnaire)

Similar sentiments were echoed by another student who wrote “I usually have things on (work, sport, socialising) during the weekend so I try and work on the weekdays if I can” (Toni, student questionnaire).

Some students indicated that they like to study at nights, both on weekends and during the week:

Not in the morning at all, I’m not a morning person so I tend to study a lot at night and I’ve found this semester at uni, like we’re doing assignments in particularly, most of my assignments have come together like after midnight so I’m kind of, I’m kind of in a better space at night to kind of do assignments than I am during the day. So just the thing, all my assignments, my parents have gone to bed and my assignment’s been quite messy and then I’ve just decided to do it and by the morning it’s almost complete because it’s just, I’ve formed it and read more and, yeah, I just find night time better for me. (Arti, face-to-face interview)

The feedback from participants about their preferred study times indicated that the preferences vary between participants. The participants, for practical reasons, choose to study whenever they can find time to do so, fitting their study around their many other commitments. Study support that is aimed to engage all students at a specific time would not be effective and therefore opportunities that enable engaging students at different times, and even study support that enables students to work on the support instructions in their own time when it is more convenient is more likely to be effective. Mobile text messages have the capability to engage student at different times, but also allow students the flexibility to refer to the text messages when it is more convenient for them to engage with their study.

Outside class study activities can take place anywhere that students feel comfortable and find that they can be effective in their study practices. Participants were also asked about their preferred places for studying and were allowed to indicate more than one preferred study location. As can be seen from Figure 2, most students prefer to study at home (97%). For example this comment from a participant states “Definitely at home. I only like studying at home really” (Arti, face-to-face

interview). The second most popular choice for study location is on campus (64%). For example another participant Kelly states that “I do most of my study on campus. I have like a five hour break between classes so I can get heaps done and I can find a quiet place in the library to do my work” (Kelly, face-to-face interview). A small proportion of participants (10%) selected ‘Other’ as their study location suggesting these students did not have any fixed study location. The questionnaire allowed these participants who chose ‘Other’ as their option to indicate their locations. A number of these students study while commuting to and from university, some even study in social locations or their parents’ workplaces, for example:

It depends on the situation during the week as to whether I get the train because I do love to read on the train, I do find that I live in Sydney, I live in Sutherland so it’s a long trip and it’s a perfect block of time for me to get one subject’s worth of reading in and reflecting and looking at my course materials as well. So, I haven’t been getting the train recently but so it’s on the train and when it’s not on the train it’s at home either on the couch, generally in front of the television, my partner has the television on all the time or like when I can’t stand that any more I go into my spare room. (Peta, face-to-face interview)

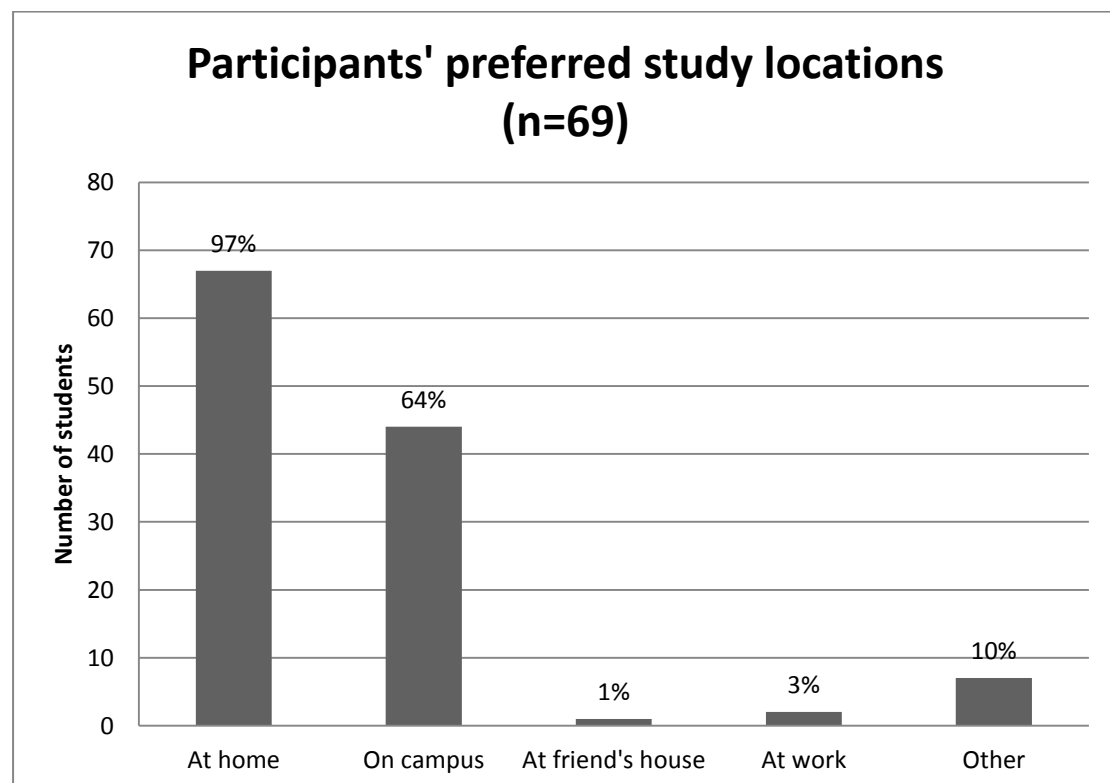


Figure 19: Participants’ preferred study locations

Participants offered various reasons for preferring different locations. For example, Filomana preferred to do most of her study at home, admitting “obviously friends can be very distracting” (Filomana, face-to-face interview).

Toni on the other hand preferred to study on campus, indicating that “because it’s the time – and the library’s pretty good – I can nearly always get a computer or a desk” (Toni, face-to-face interview). Tian also can get her study done on campus during here break, indicating “spending the hour break I’ve got studying” (Tian, face-to-face interview).

While participants indicated different places where they preferred to study, they also selected multiple locations to study. For example one participant indicated she has to change study locations as because “I get bored of sitting in the same place all the time” (Kelly, student questionnaire).

In sum, although most participants preferred to study at home, they also vary their study location to suit their needs, and, in some cases, they will move between study locations to ensure they are able to maintain concentration.

Although peer learning is prominent in discussions of higher education (D. Boud, et al., 2001; Gurtner, et al., 2011), as Figure 3 indicates, almost all of the participants preferred to study independently.

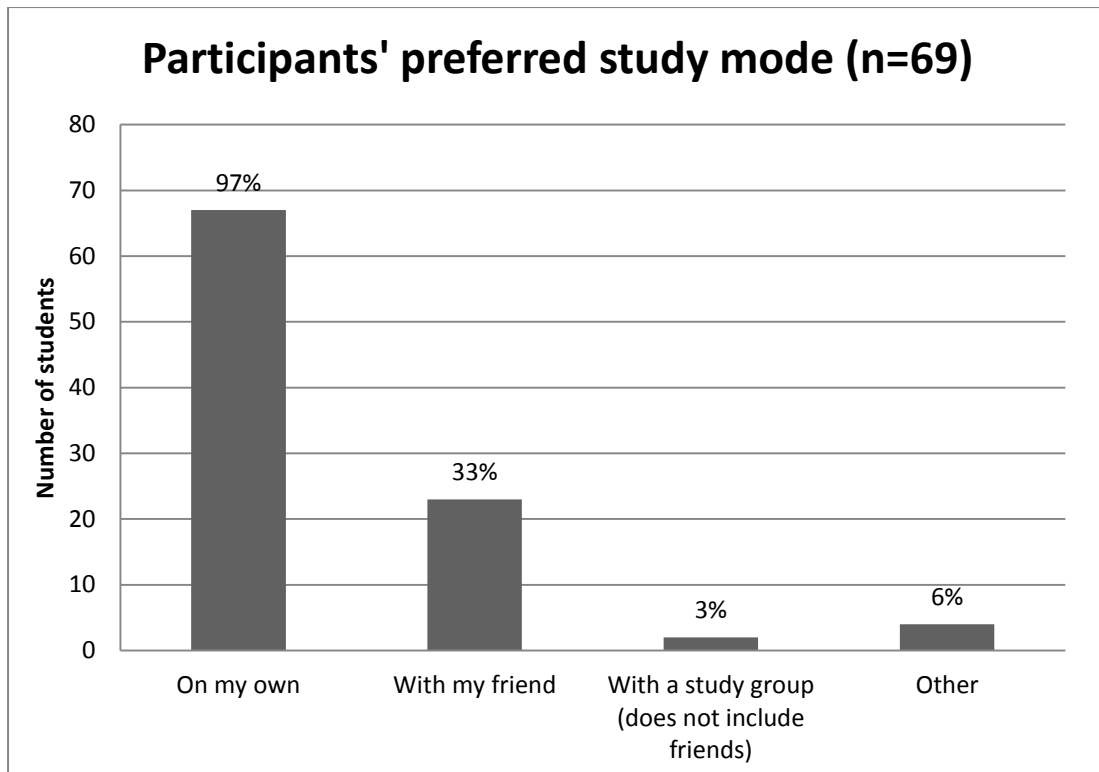


Figure 20: Students' preferred study mode: peer or independent

This aspect also allowed participants to indicate more than one study mode that is, they were able to select for example that they study independently, as well as with their friends, study group or other. Thirty percent of participants (21 of 69) indicated that they preferred to study independently as well as with a friend. For example Cheryl mentioned “that I prefer to study on my own, get my ideas and then have a group that’s like a study time and talk about it” (Cheryl, face-to-face interview). Only two participants indicated that they preferred to study exclusively with friends. The majority of participants prefer to study independently, unless they have to work collaboratively due to subject assessment requirements. For example Peta indicated that “it just depends on the subject sort of thing like where I have to study with someone for that subject” (Peta, face-to-face interview).

Marry who preferred to study independently summed up as “if I really need to get something done, I’ll just have to like make sure I’m not with anybody else, because that’s too distracting” (Marry, face-to-face interview).

The four participants who indicated that they studied with people other than their friends or peers often mentioned that they prefer to get help with their studies from their parents. For example, Tatiana mentioned that “I usually talk to my mother about the subjects, bouncing ideas off her and talking about what I know” (Tatiana, student questionnaire). Arti made a similar comment “.... and I’d get my dad to quiz me so he’d have my notes and he’d say, ‘so, what’s this?’ using those notes and that really helped” (Arti, face-to-face interview). Similarly, “I explain concepts to my mum” (Stephanie, student questionnaire).

Based on the findings about the participants study mode, it can be said that studying is generally a personal endeavour. Although thirty percent of participants indicated that they also study with friends and peers, they prefer to do their personal study first before engaging in any form of peer studying. Similarly, participants who indicated that they get help with their studies with their parents, also indicated that they studied independently first before seeking help. Study skills support that is individually targeted would be able to engage students when they are studying independently.

The overall profile of participants indicates that generally they prefer to study at different times of the day and week according to the time available in between their various non-study related commitments. Although majority of the participants tended to study on weeknights, they would also study whenever they get some free time do so. Participants also did not have one fixed location to study even they indicated their home as their main study location, participants often move between different locations and fit in study wherever they can. Participants also indicated that they prefer to study independently. Even though some participants indicated that they also study with friends or with the help of their parents, their first attempt is always to study independently. Based on this profile of the participants, mobile learning seems a suitable medium for engaging with them to help them develop their study skills.

7.4.2 Impact of mobile learning on participants’ lifestyles, social activities, work commitments, and other non-university responsibilities.

It is not uncommon for students’ personal text messages and general mobile phone use to disrupt their formal learning activities, such as lectures and tutorials.

Sending study-related text messages to students when they are not at university and possibly participating in their personal activities (such as work, socialising and sports) could be experienced as disruptive and unwelcome. Interrupting students when they are not studying for example when they are at work or socialising can lead to students completely discounting the text messages. Similarly just by sending the text messages does not necessarily mean that students will follow the instructions. One of the disadvantages of text messaging is there is no way to follow-up on the actions of the students.

However, as can be seen from figure 4, when asked if the text messages were disruptive, most participants (87%) indicated that they did not find the text messages at all disruptive, with only a small number (23%) indicating that they found the text messages mildly disruptive. More importantly, none of the participants indicated that the text messages were extremely disruptive.

Most of the participants in the study received a number of text messages each day from a variety of sources, other than as part of this research study. When interviewed, Toni explained that she would “probably get maybe, depending on the day, 25 [text messages] a day roughly”. Managing text message communications was considered routine for most participants, for example, Arti said, “it allows me to multi-task and communicate with many people at once” (Arti, face-to-face interview). Participants reported that the text messages they received as part of the study were successful in diverting students’ attention from whatever they were doing when they received the messages. For example, “I read the message thought about it but it didn’t disrupt my routine” (Jenna, student questionnaire). On one occasion a student received the text message when he was in bed and even then he did not find the text message annoying, as indicated by “Yeah, it was just next to my bed so I looked at it, saw who it was from and went, ‘Okay’” (Sherine, face-to-face interview).

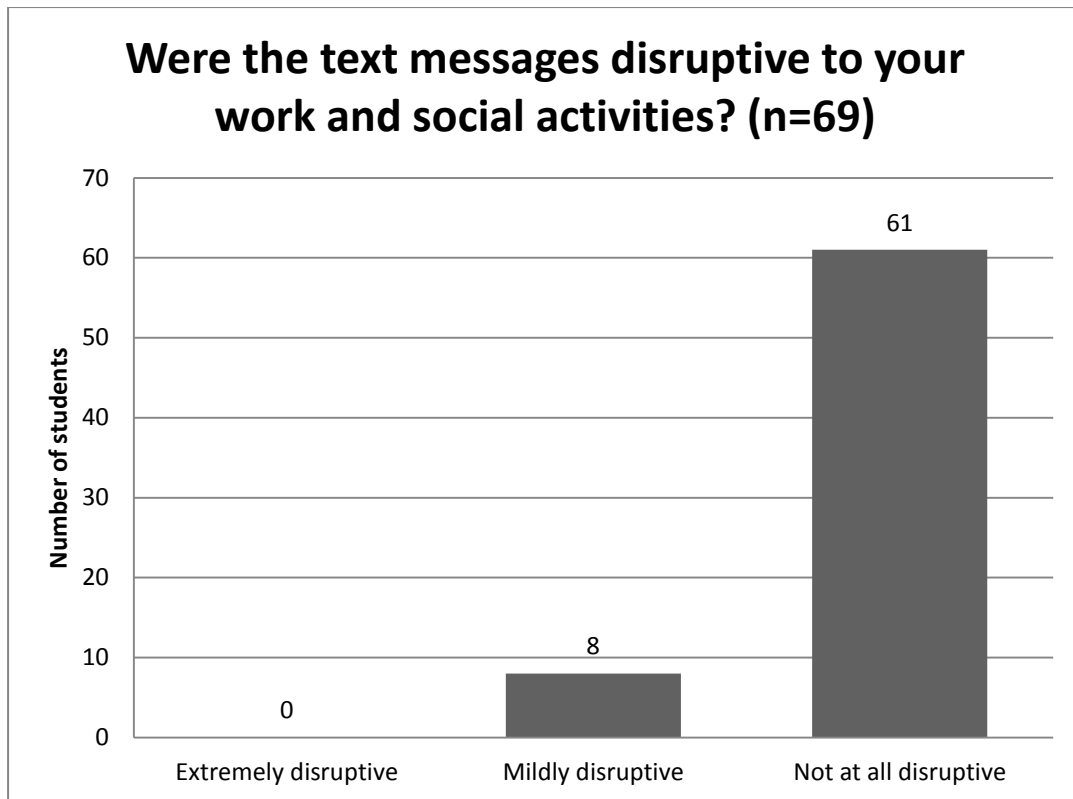


Figure 21: Were the text messages disruptive?

The text messages were intended to capture participants' attention and their responses indicate this was successful. Even though students checked the text messages in the middle of whatever they were doing, they did not find it annoying or inconvenient. The text messages, then, were certainly interrupting the activity the students were engaged in, but they did not find the experience so disruptive as to have to stop their activities completely; they were able to resume their activities after attending to the text messages.

The participants in this study did not feel that the study related text messages that they received were disruptive whereby they could not continue concentrating on whatever they were doing when they received the text messages. The text messages were successful, however in capturing participants' attention and therefore shift their attention towards study, even if for a very small moment while they looked at the text message.

All the text messages were scheduled to be sent between 7.30am to 10.30pm, however due to the nature of the technology employed to send and receive bulk text messages, some text messages can sometimes be delivered outside of these times. This can occur for various reasons, for example if the computer server used to store the text messages is not ready to forward the messages when intended, or if the mobile phone network is not available to send and receive the text messages. This is the nature of the technology and very little can be done to avoid it, however it must be noted that the majority of text messages were delivered as scheduled.

In this study, over 1120 text messages were sent to all the participants and only one text message arrived outside of the scheduled time. During the face-to-face interview, one participant commented that even though she received the message late at night when she was asleep, she did not find it annoying:

Not so much. I mean if I hadn't been able to get back to sleep it would have been but I kind of just went straight back to sleep and it didn't really affect me at all, I'd kind of forgot, by the time I woke up in the morning I'd forgot until I looked at it and I thought 'oh yeah, that's right, I got a message at that time'. It wasn't too bad. (Arti, face-to-face interview)

Participants generally are able to ignore or attend to their text messages at different times of the day, and even expect some text messages to arrive when they are sleeping. Based on these comments, students generally do not find the text messages annoying, even when they receive them at inconvenient times.

In fact, one participant felt good that someone else was actually interested in helping them succeed at university as indicated by this comment:

I felt, well actually I felt more of the urge to say, 'Thanks', than anything and I felt like, because we had met you in a couple of situations and saw you in a lecture and we saw you in tutorial I felt like there almost was a bit of a relationship being built you know, with this magical man on the other end with the SMSs. (Peta, face-to-face interview)

Overall, text messaging can be considered a reliable and cost-effective technology to utilise to support students outside of class time. Sending study related text messages to students does not automatically mean that they will follow the instructions. For

example this comment from Cathy who said “I didn’t really follow up on it because it came at a time when I wasn’t working on those things and I found it difficult to go back to it” (Cathy, face-to-face interview).

Students are adept at managing their mobile phones and in particular their text message communications. They can choose when they need to attend to their text messages and when they should turn the notifications off. For example, “I kind of always have my phone on silent at work and stuff so if I have received it then I wouldn’t know until after anyway so it’s not inconvenient or anything” (Cheryl, face-to-face interview). Participants commented that the text messages were not disruptive as they could choose to attend to them as they were received or wait for a more convenient time. For example John commented that “I did not really consider the information because I already have a set way of doing things” (John, student questionnaire).

Students do not feel disturbed by the text messages to the point that they have to stop whatever they were doing, rather, it appears that the text messages were successful in getting students engaged with the message content, in some cases, subconsciously:

I think it did and I think that even, even when I’m doing something study wise, now I will go back and have a, ‘Oh, okay let’s think of the main things, write a list and then summarise’, because you know, that’s something that did stick with me throughout and I think subconsciously yeah I did. (Peta, face-to-face interview)

Mobile text messaging is able to interrupt participants in whatever activity they are engaged in when they receive the text messages. The findings indicate that even when participants receive text message at inconvenient times they do not feel disrupting to the point that they cannot concentrate on whatever they were doing. Even though the mobile phones technologies are reliable enough to ensure text messages are delivered on time, sometimes text messages can be delivered outside of expected time, and in this study the participants did not feel affected when the text message arrive at inappropriate time. Mobile text message-based study support, rather than being annoying, was very well received by the participants.

7.4.3 Participants experiences of receiving study support via text messaging

Student experiences are a subjective concept. Different students experience mobile learning in different ways based on their circumstances. However when asked about their experiences with receiving the text message-based study support, as indicated in Figure 5, most participants (57 participants) reported that they had ‘excellent’ or ‘good’ experience.

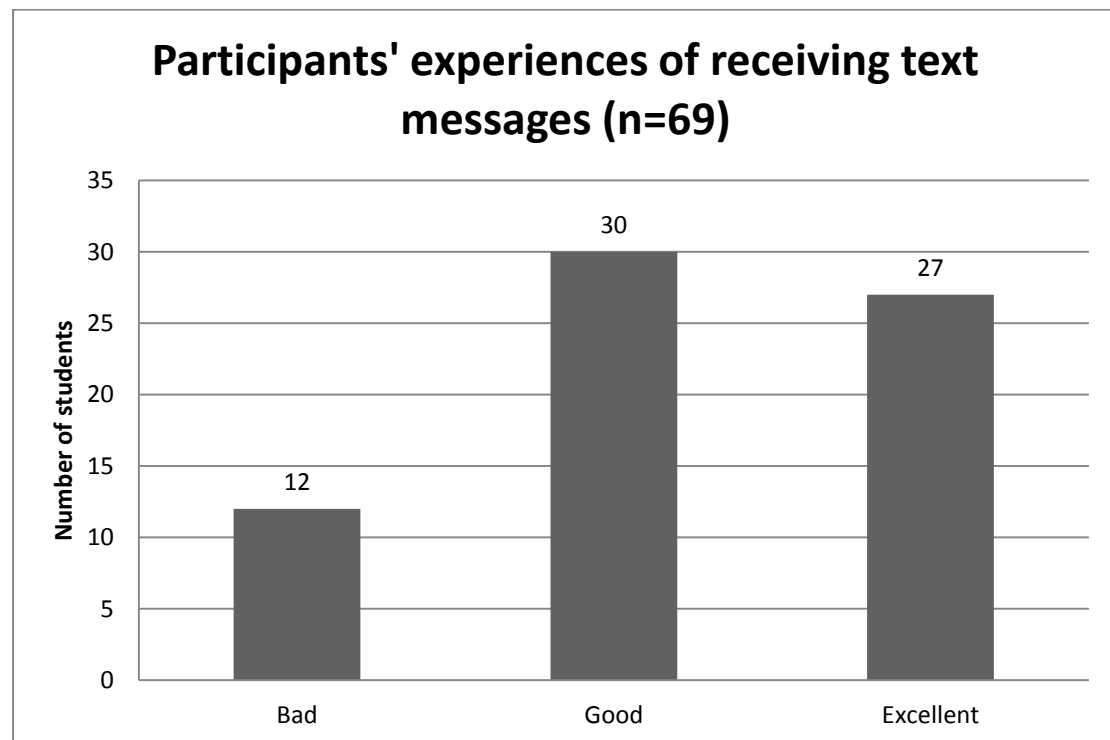


Figure 22: Participants’ experiences of receiving text messages

Regardless of whether the participants attended to the text message instructions right away or returned to the message at a more convenient time, the participants commented in the comments section of the questionnaire that the text messages got them thinking about studying and that they found the tips useful. They also indicated that the messages were encouraging and it was good to get ‘bite sized’ tips. For example the comments from these two participants sum up these sentiments:

Motivated me and made me think about doing study when I was out doing other things. (Devlin, student questionnaire)

They helped me focus on different study strategies and worked as a reminder to study. (Brent, student questionnaire)

Just over 17% (12 participants) rated that they had a bad experience receiving the text messages as part of this study. They indicated that the messages were "common sense" (Tom, student questionnaire) and that some of them already knew how to study. However, the messages did make some participants feel guilty about not studying, even if they did not follow the messages, for example one participant, Petkovic, commented: "The SMSs guiled me into study, but other than that didn't really affect my study on a conscious level, but according to the data, it has improved on a subconscious level" (Petkovic, student questionnaire). Some of these participants also felt that the messages arrived when they were busy doing other things as commented by Jacob: "Didn't really help that much, but I think it was due to the fact that the messages came at inconvenient times" (Jacob, student questionnaire). Some participants who indicated that they did not find the text useful mentioned that they had their own way of studying. This highlights that first year university students often continue using the study skills strategies that they have used in the past, and may find it difficult to adopt newer strategies as they transition to new learning environments (Schunk & Zimmerman, 1998).

Even though some participants did not find the experience useful, as indicated by the following comment, they did find the messages worthwhile and are likely to attend to the messages at a later time: "It was at inconvenient times but because it can be saved I might look at it later" (Zillinsky, student questionnaire). Similarly another participant, Cathy commented that:

I think the way the SMS's are structured where if you don't answer it straight away it's sort of almost lost, well it is to me, I just forget about it then there's nothing to remind me about it. Whereas if it was something like an email then I could mark it as unread or highlight it in some way. (Cathy, face-to-face interview)

Different participants experienced the text message-based study support in different ways. It is important to note that majority of the participants did not find the experience bad. Although the text messaging format is convenient, it may not appeal to all participants.

Associated with their experience is the perception of the participants about whether thought that the text messages were helpful for their studies. This indicates if the participants engaged with the content of the messages. Participants are more likely to indicate that they thought the text messages were helpful if they followed the instructions and realised, for themselves, the effectiveness of it (Veenman, 2011).

Most participants either found the text messages either extremely helpful or moderately helpful for their studies. As can be seen from Figure 6, approximately seventy-five percent of participants (52 participants) indicated that the SMSs were helpful.

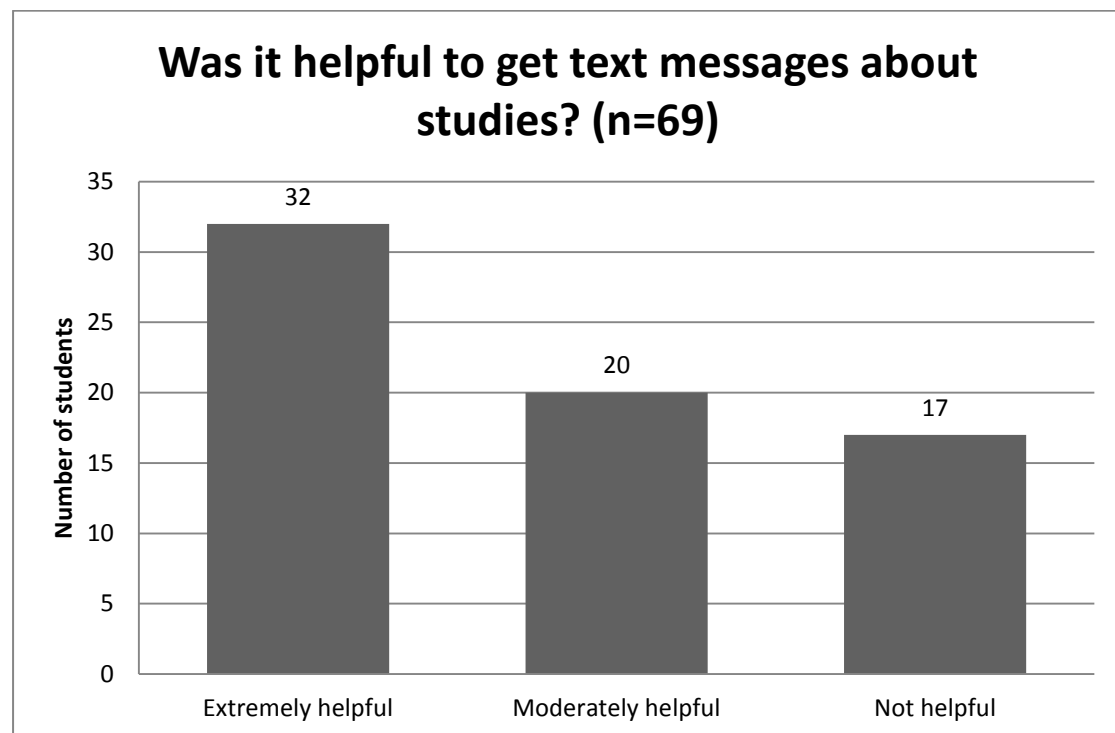


Figure 23: Were the text messages helpful?

A similar question was explored during the face-to-face interview. This comment emphasises that most students did find the text messages helpful:

What I was able to do, is looking at that, I was like – thinking actually back on when I was in Year 11 and 12 – I did do some of those things, or I was thinking about, yes, when I actually get to the time when I'm going to study these

subjects, I'm like yes, working on the harder subjects first is good. And yes, I was thinking about it, not actually currently was doing it, but like briefly thought. (Kelly, face-to-face interview)

Similar comments were made by another participant:

Yeah, I did think it was useful and I was virtually thinking, 'Oh I wonder who's going to do all this', because it would be really useful for first year you know, to implement as a thing that you know, you could either opt in or opt out of and that the use of the technology is ingenious because we've always got our heads in our phone and it's something that we won't ignore and it's, you know it's easy to delete an email; it's easy to just you know ignore what someone says in front of a tutorial but the technology that a lot of us are really focused on, especially with the capabilities of phones these days with the diaries and you know the reminders I think it was absolutely fantastic. (Peta, face-to-face interview)

Just over twenty-four percent of participants, however, indicated that they did not find the text messages helpful. One of the common themes from participants who did not find the text messages helpful was that they received the messages when they were not studying. For example, "The messages came at a time when I was not working on university study" (Cathy, student questionnaire) and "it would be better if they were timed to come when I was studying" (Jacob, student questionnaire).

Participants' perceptions indicate that the text message-based study support is generally considered as helpful by the participants. It was important to gauge participants' perceptions about if they thought that the text messages helped them improve their study practices. These perceptions indicate if the participants were receptive to the study support that was delivered via text messages. The results indicate that use of text messaging format for study support may not be suitable for all participants, and some participants think that email would be a more suitable medium for study support.

In sum, the findings of this study indicate that mobile phone text messages are convenient ways to engage with participants outside of class time. The participants

indicate that they are good at managing their mobile phone text message communications and have developed strategies to screen and attend to text messages according to priority. However, the participants also indicate that the text messages used in this study was able to divert their attention from whatever they were doing towards their studies. The participants did not feel that the text message were disruptive enough to stop them from continuing on with what they were doing, even though they would stop briefly to see the text message on their mobile phone. Even when text messages arrive at inconvenient times due to failings in technology, participants did not feel that annoyed by it. According to the participants in this study, by contacting them during their outside class time, they felt that the university was demonstrating its duty of care and the participants appreciated that.

Even though the mobile phones and text messaging provides universities the opportunity to contact students in their outside class times, there is little that can be done to actually get students to follow instructions to study, and more importantly the text message technology does not have the feature to provide feedback if students actually engaged with the study instructions. Some participants indicated that they did not find the text messages helpful for their studies. This supports the argument that even though students do not feel interrupted by the text messages, it does not indicate that the text messages then lead to acceptable study behaviours. Participants who did not find the text message instructions helpful indicated that they already had their own way of studying. This supports the discussion in the literature that students often continue to use their study strategies from previous educational environments, even if those might not be effective and find it challenging to transition to new learning environments (Schunk & Zimmerman, 1998). Other reasons why some participants did not find the text messages helpful was because some participants did not like the medium of text messaging used for study support as well as indicating that the text messages were received at inconvenient times when they were not ready to study.

The findings of this study indicate that text messaging is a convenient medium to use to engage students in their outside class times, it may not suit the diverse student population in first year of university.

7.5 Discussion

There is an increasing interest among universities to utilise the ubiquitous nature of mobile phones to engage with students during their outside class time (Breuer, et al., 2007). Mobile learning is discussed in the literature as being able to bridge the gap between inside class, or formal learning and outside class or informal learning (Kukulska-Hulme, 2007; Sharples, et al., 2005). Although mobile phones enable universities to contact students when they are outside class may not necessarily translate into positive learning outcomes.

This study aimed to understand the impact of sending text message-based study support to first year university students' mobile phones during their outside class times. The study was conducted with 69 first year Bachelor of Education students enrolled in an introductory educational technology subject at the University of Wollongong. The findings of this study confirm the diverse background, in terms of study styles and learning needs, of participants (Laurillard, 2002). The participants' indicated that they tended to study whenever and wherever it was convenient, in between the various extra-curricular activities they were involved in. The findings further indicate that the majority of the participants were receptive to text message-based study support. Although a number of text messages were received by the participants at inconvenient times, they did not find the text messages disruptive, and were able to get back to their activities after attending to the text messages.

Just because students carry their mobile phones all the time, expecting them to engage in learning content they receive on their mobile phones could be construed as an invasion of their privacy. Students may experience content sent to them as an unwelcome disruption, unlike instances where they seek out content themselves. One of the shortcomings of text message-based study support was highlighted by some participants in this study whereby the study instructions were ignored by some participants. Merely sending text messages to students does not guarantee that they will follow the instructions, particularly if the text messages were received when students were busy with non-study activities like sports. Although a majority of participants in this study found the text messages helped them in their studies, for some it was not helpful as they continued to practice their previous ways of studying.

This study has been able to demonstrate that by sending appropriately targeted, customised text messages to participants' mobile phones, it is possible to engage some participants to shift their thinking towards appropriate study-related behaviours, regardless of their location or activity they may be engaged in at that time.

Claims of “anytime, anywhere learning” (Kekwaletswe, 2007) are abundant in mobile learning literature. A number of studies have concluded that the affordances of mobile phones (such as their convenience, expediency and immediacy) make it possible and desirable for students to access learning content at their convenience (Colella, et al., 1998; Kukulska-Hulme, 2007; McManus, 2002).

Recently, studies have begun to explore the role of mobile learning on students' informal learning spaces (Looi et al., 2010). For example outside class, informal mobile learning has been found to be effective in enabling students to learn a second language in real world settings (Ros i Solé, et al., 2010). Similar findings were reported when students participated in language learning games software that they played on their mobile games console outside of class (Kondo, et al., 2012). Students generally appreciate the opportunity to be able to engage with their learning when they are not in class. These findings are from studies that gave students the opportunity to engage with the learning when it is convenient to them (Kondo, et al., 2012; Ros i Solé, et al., 2010). Although these are encouraging findings, however, these findings do not capture students' responses when they are interrupted to engage in learning as has been done in this study.

This study confirms Bernstein's classification theories that suggest that students keep their various parts of their 'lives' separate, that is, although they have the ability to access learning resources all the time, they often do not and only engage in learning activities at designated times and places. Many university students engage in numerous activities and have responsibilities outside of their studies and are therefore often time poor. Although students can access learning content via their mobile phones, for practical reasons they may not access it frequently, for example they may not realise that it is important enough to access learning content using their mobile

phones or because they are so busy with extra-curricular activities that they do not have time to engage in mobile learning and learning generally. Text messages can be used to interrupt students and ‘force’ their attention towards studying regardless of their setting they are in (Ismail, et al., 2009; Jones & Edwards, 2009). Text messaging technology can be used to ‘push’ the learning content to the students, as opposed to students choosing if and when they wish to learn (Vigar-Ellis, et al., 2007). Students can choose to stop what they are doing and check at their messages, even very briefly, and that can be enough to shift students thinking towards study (Hjorth, 2005).

The participants in this study indicated that their study times and places vary to suit their lifestyle and commitments. In most cases, students tend to study independently with little or no support available from teachers or peers. In cases where students do receive study support, it is generally from their parents, who may not necessarily be the most qualified to provide specific guidance on the most effective study strategies.

The text messages that were sent as part of this study were devised to interrupt students in their outside class, informal learning spaces and shift their thinking towards formal learning. As indicated by the participants they tend to be involved in various non-study activities when they are outside class, and therefore contacting them during these times will potentially interrupt these activities. The results suggest that students do pay attention to the text messages, and in many cases, if they have time, do follow exactly the instructions. Although it is not possible to know exactly how the text messages were handled when participants were not able to follow the instructions right away, they did indicate that they were able to think about the text message instructions. As a strategy the text messages were successful in prompting many students to think about their studies, even though they were engaged in non-study activities. For some participants, though, the text messages were not engaging and these participants were unable to follow any of the instructions to study. These participants indicated that text messaging was not a suitable medium as they tend to forget the instructions, even that they received the text message, if it was received when they were busy. They report that something like email would be more suitable for them. First year university students are a very diverse group and a single strategy to engage them to study will not appeal to all.

Some participants also reported that even though they were receptive to the text messages, they were unable to change their study strategies which they have used for a while. Students find transitioning to new learning environment and tend to revert to study strategies that they are familiar with, even if they are not very effective (Schunk & Zimmerman, 1998). Although experience alone does not necessarily indicate effectiveness in learning outcomes, students who have enjoyable learning experiences tend to engage with the learning activities, which usually results in positive learning outcomes (Sattler, Spyridakis, Dalal, & Ramey).

Students use their mobile phones extensively, with text message communication being the most used application. It is not uncommon to find students sending and receiving text messages while they are in class. However, most university lecturers request that students switch off their mobile phones as it can be disruptive. Both teachers and students report that they are unable to concentrate on class work if calls and messages are being received.

Appropriately designed, targeted and customised text messages sent to students during their informal time not only engage students but also can provide a pleasant experience for them. Students feel as if they are being cared for by someone, and this can motivate them to learn. The study reports that if the text messages were merely random reminders without any customisation, they may not be as effective. Indeed, a significant opportunity offered through mobile learning is the potential for learning to be customised, not just in terms of context, but also in terms of students' individual learning needs, in particular the development of generic study skills.

The text messages sent during this study interrupted or disturbed students while they were attending to personal activities and shifted their thinking to appropriate study-related behaviours. It was found that students were able to continue to work on their activities after attending to the text message, and could refer to the text message in more detail at a more convenient time.

Based on this background, it would be expected that students would be uncomfortable receiving study-related text message during their private, informal time. However, students actually appreciate receiving study-related text messages, and report a generally positive experience. Sending text messages to students in their own time disrupts students' activities and forces them to focus their attention on their studies.

The way in which the text messages were used in this study acted as a reminder for the participants to study, and also served to engage them in appropriate, relevant study processes. Unlike email or social networking, the text messages were designed to interrupt participant's activities and provide active study skills support. Considering students are always using their mobile phones, this implementation was considered innovative and effective by some participants. Even though similar support can be provided through face-to-face activities such as tutorials and study skills workshops, participants indicated that text messages were more engaging, as they tended to switch off during face-to-face sessions for a number of reasons, not least of all, the personality of the presenters.

The text messages distracted students from whatever activity they were involved in and moved their attention back to their studies. When participants received the text messages, it effectively forced students to stop, albeit momentarily, what they were doing and start thinking about appropriate ways of studying.

The actual structure of the text messages, although very targeted, was still flexible enough for participants to deal with it in their own way, that is, participants could attend to it right away or leave it until a more convenient time. Participants were also able to interpret the messages in their own way and apply them to whatever subject or topic they chose. Students generally want to feel that they are in control of their learning and by enabling the messages to be flexible, the control of learning was still with the students.

The findings of this study are based on participants self-report about their experiences with receiving study related text messages during their outside class time. Data was collected using the end-of-study questionnaire and an end-of-study interview. Both of

these instruments depend on students to provide self-reports about their experiences based on their memory and interpretations of events. Depending on their memory to recall past events, it can limit the validity of the data they provide (Veenman, 2011). In this research, data from different sources was triangulated to confirm the results and understand the study behaviours of students.

Participants indicated that they had built a rapport with the researcher, where they felt that they were being ‘cared’ for by researcher and appreciated the study skills support that they were getting. Participants’ feedback about their experiences in this study might have been influenced by them indirectly showing gratitude through the more favourable comments.

With recent and future advances in mobile technologies, including location awareness and seamless integration with online data sources, other areas that could be explored for further research could include the utilization of emerging technologies in gamification, and location-awareness (Johnson, et al., 2014). Gamification involves using the game technology in educational settings. Aspects of gamification can be useful in prompting participants in various study related activities based various things like the need to study, times and days of the week. More importantly, gamification will be able to collect and provide more real-time student participation data which can be used for analysing learning and engagement more effectively (Winne, 2014). Location-awareness is the feature of mobile devices to identify its physical location, and by utilising these, students can be prompted only when they are in environments that are conducive to study.

Although mobile devices are extremely common amongst the higher education students, mobile learning activities must be thoughtfully designed, appropriately informed by current theories about learning and engagement. This study used Bernstein’s classification theories to design the mobile learning activities to engage students during their outside class learning times and the self-regulated learning theories were used to help students improve the study skills.

7.6 Practical implications

Universities and higher education institutions are often very effective in providing content-related support through face-to-face, online and, in some cases, mobile networks, however they can be more proactive in supporting students with their generalist study skills support. With university funding sources on the decline and student numbers on the rise, mobile learning provides a feasible, cost-effective opportunity for faculties to connect with students for support and communication. Indeed, various implementations of mobile learning have been able to demonstrate the technological viability of study support via mobile phones and other mobile devices.

Mobile learning that enables students to access learning content via their mobile devices can be regarded as passive support as students can access the resources at their convenience. Sending study-related, targeted and customised text messages to students and engaging them cognitively and physically into appropriate study action, is considered an active form of support. The text messages distract students from whatever they are doing. Students feel more connected to their learning due to the active nature of this contact. Contrary to assumptions that students do not like receiving these study-related text messages, they actually feel like they are being cared for and that they are not alone when they are studying.

The engaging of students through text messages can be considered as students being “transported” (Hjorth, 2005) virtually from informal learning spaces to formal learning spaces. For example, if students receive a text message about university studies while they are attending to carer duties, they momentarily pause their activities and attend to the formal interaction by replying to the text message. Students are therefore ‘transported’ from the physical space to a virtual space via their mobile phone while they attend to and respond to their text message. The physical location in this example represents the students’ informal learning space since it is away from the university campus or other dedicated learning spaces. By attending to their text message, students remain engaged with their learning even though they are located in informal learning spaces.

7.7 Conclusion

This study makes significant contribution towards knowledge about engaging with first year university students' during their outside class time using mobile phone text messages. The study sent a number of text messages to participants during their outside class time, prompting them to engaging in effective study behaviours.

The results show that participants are generally receptive to the text message instructions for study support. Even though the text messages were designed to interrupt participants when they were engaged in various non-study related activities, the participants did not find it disruptive. However, not all participants followed the study instructions contained in the text messages. For these participants, getting the text messages at inconvenient times was not effective and therefore they tended to ignore these text messages. Some participants also found it difficult to change their study habits. The findings indicate that an inclusive strategy to engage with all students during outside class time, should attempt to employ a number of technologies like text messaging, email and even social media.

Mobile phones provide a cost-effective and feasible medium to contact students during their outside class time. Universities do not require large investments in personnel and infrastructure to provide this type of support. Successful implementation can lead to more effective inside and outside class transfer of knowledge and skill improving student outcomes at universities and other similar higher education institutions.

7.8 References

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8 CONCLUSION

8.1 Introduction

This research investigated how first year university students could be supported to develop independent study skills using mobile learning outside class. In this study, ‘independent study skills’ refers to the ability of students to apply a range of learning strategies to self-regulate their learning. Mobile learning is a broad concept, and has been used in this study as a means to engage students outside of class time using the text message technologies to help them apply appropriate self-regulated learning skills.

The study was implemented in two stages: first a preliminary study was conducted to identify and deploy relevant mobile text message technologies capable of reliably sending and receiving bulk text messages. The preliminary study was informed by Vygotsky’s Zone of Proximal Development theory (Hogan & Tudge, 1999) and Bernstein’s (1971) classification theory. The preliminary study was also conducted with the aim of understanding students’ reactions to receiving text messages for study purposes when they are outside class and begin to understand the impact of using persuasive text messages on students’ learning behaviours. Although text messaging is a relatively common practice among mobile phone users, sending and receiving bulk text messages requires careful planning and use of appropriate technologies. The main finding of the preliminary study was the identification and deployment of an online ‘SMS Gateway’, a web-based system to send and receive bulk text messages capable of scheduling and sending text messages automatically. The other key findings were that the participants were receptive to the study-related text messages during their outside class time and the persuasive text messages tended to have a positive impact on participants’ learning behaviours by helping them improve their confidence in the subject topics. The findings of the preliminary study also highlighted that the participants did not prefer to collaborate with peers when they were studying, despite text message prompts to encourage them to do so. The findings of the preliminary study were used to inform the design and implementation of the main study by utilising the online ‘SMS Gateway’ and focusing on developing independent study skills. (For more information about the findings of the preliminary study please refer to Chapter 4)

The main study used the online text messaging system identified in the preliminary study to design a study skills development program to support first year university students to develop their independent study skills. The study was theoretically informed by self-regulated learning theories (Pintrich, 2004) to identify and develop students' cognitive learning strategies, and the concept of classification (Bernstein, 1971) was used to conceptualise the boundaries that exist between students inside class and outside class learning.

Students independent study skills were developed by helping students develop their self-regulated learning skills using a study skills development program delivered using mobile text messaging technologies. The study skills development program was designed to identify and develop students self-reported abilities to apply the cognitive learning strategies of the self-regulated learning framework (Pintrich, et al., 1991).

The primary focus of this research was on the research questions and findings of the main study. The research questions addressed in this study are:

1. How can first year university students be supported to develop their independent study skills using mobile phone technology?
2. How does the use of mobile phone technology influence first year university students' engagement in learning outside class?

The findings of this study indicate improvements in participants' self-regulated learning skills as well as positive experiences with learning outside of class time when engaging with the study skills development program delivered via mobile phone technologies. The following sections provide a discussion of the findings for each of the research questions. These are followed by sections discussing the limitations of the research, implications for practice, implications for theory, opportunities for future research and a final summary.

8.2 Key findings from research question 1: How can first year university students be supported to develop their independent study skills using mobile phone technology?

The results of this study indicate that mobile phone technologies are suitable tools to deploy strategies designed to develop first year university students' independent study skills. By participating in the study skills development program delivered via mobile text messaging technologies, participants were able to improve their cognitive learning strategies, which is part of the self-regulated learning skills framework. Participants further indicated that the improvement in their cognitive learning strategies were attributable to the persuasive text messages they received as part of the study skills development program. The findings indicate that participants are inadequately prepared for university studies and although they use their mobile phones extensively, it is underutilised as a tool for supporting their learning. The key lessons learnt from the findings of this study about supporting students to develop their independent study skills using mobile phone technology are discussed below.

8.2.1 Students' are inadequately prepared to tackle independent university studies.

The background of participants in this study reflect what has been identified in other studies that first year university students come from varied educational backgrounds (Laurillard, 2002). A small majority of students in this study came directly from high school, with a number of other students having had some work experience and some post-secondary studies other than university. Students in this study indicated that they bring with them the learning skills and habits that they have used in previous study environments like high school, post-high school institutions, home schooling or overseas institutions. Similar trends are reported in the literature that suggests that transitioning to a new learning environment can be difficult for most first year university students and therefore students continue to use all the learnings skills and habits that they have used in the past (Schunk & Zimmerman, 1998).

The participants in this study indicated that they find university studies challenging and often struggle to study what is being taught, focusing on completing assessment tasks rather than spending time on personal study. Similar findings are reported in other studies where students treat the education process as a means to fulfil

examination and assessment requirements only (Astin & Antonio, 2012; Laurillard, 2002). The findings in this study indicate that participants do not employ any strategic study techniques, but rather use what seems to have worked for them during their previous study environments like high schools, in most cases employing strategies involving reading and re-reading lecture notes and text books. However, studies have shown that independent learners need to apply a range of study skills for effective independent study (Zimmerman, 2000). It was evident from this study that most of the participants in this study do not apply more effective and proven study strategies.

Universities expect students to be independent learners, with the ability to manage their own learning according to expected outcomes. These independent learning skills become even more important as universities embrace a range of more sophisticated teaching, learning and assessments paradigms that encourage experiential, authentic learning experiences as well as adopt more robust means to evaluate students abilities to apply knowledge outside of examinations settings (Boud, Lawson, & Thompson, 2014; Laurillard, 2002). Students' ability to develop these independent study skills greatly determines their success or otherwise at university. Although some students will develop these independent study skills on their own, others will need explicit help with it (Cleary & Platten, 2013; Zimmerman, et al., 1992). Studies have shown that with effective training it is possible to develop these independent study skills through "direct teaching, modelling, guided and independent practice, feedback, self-observation and social support" (Torrano & Torres, 2004, p. 17). Given the importance of independent learning skills for university students, development of these skills cannot be left to chance, every effort must be made to ensure appropriate and relevant support is provided to students to help them develop these skills as quickly and efficiently as possible.

The participants in this study also indicated that they have very busy extra-curricular commitments, for example sports, carer responsibilities and the like. These students go on to indicate that because of their busy 'after-university' schedules, they try to fit in studies whenever, and wherever they can, often spending very short amount of time on studies before moving on to other activities. The findings of this study indicate that

students' study patterns tend to be very ad-hoc and based on their convenience. This trend is confirmed by studies that indicate that with increases in student numbers comes increased diversity in learning needs and styles (Wagner, 2005). Thus, the times and spaces that is convenient for studying differs between students. Universities will find it increasingly difficult to address this diversity of learning needs and styles and will need to take advantage of opportunities provided by technologies to create more individualised learning support (Kukulska-Hulme, 2007).

The findings of this study indicate that the participants use their mobile phones extensively for social media and social communications especially using text messages, but do not use it to support their learning in any way. Given the various forms of applications and features that are available on most modern phones, it would have been expected that students utilise their phones a lot more for study support. The literature review conducted as part of this research also confirms that there are opportunities to use students' mobile phones to help students develop their self-regulated learning skills.

The results of this study did not identify any specific reasons why participants do not use their mobile phones to support their learning, even though they use it extensively for various other activities. It was evident from this study that when participants do choose to spend time studying, they prefer to study in places that are away from distractions. Modern mobile phones are feature rich, making various forms of communication, for example voice, 'texting', social media and in-game, extremely easy to initiate and maintain. Most mobile phones also enable students to engage in entertainment activities like movies, music and games (Carayannis, Clark, & Valvi, 2013). Although mobile phones provide educators with opportunities to engage students to study during their outside class times, the feature-rich affordances of mobile phones may actually act as a distraction from studies.

8.2.2 Effectively designed, relevant study prompts in the form of text messages can be used to encourage students to engage in appropriate study behaviours.

The participants in this study indicated that the text messages were successful on catching their attention regardless of their context. Compared to other forms of

electronic communication like email, social media and the like, text messages can be extremely effective in gaining immediate attention (Hjorth, 2005). The text messages prompted participants to at least look at their phones even when they were engaged in activities like work or caring for children, though they may have been unable to follow the instructions at the time. If their contexts permitted, the participants followed the instructions contained in the text messages and applied the study strategies. In cases when participants were unable to apply the strategies right away, they indicated that they made a mental note about it and came back to the text messages when it is more convenient for them, for example when they were studying. The participants further indicated that for this reason in particular they preferred convenience of receiving the study support via text message as opposed to email or other social media messaging as the text messages were always available regardless of the quality of mobile Internet coverage and they did not have to log-in to another system to access the study instructions.

In situations when it was inconvenient for participants to follow the instructions, a number of them indicated that they would make a mental note of the text message to get back to later. Participants indicated that they would often think about the content of the text messages as they went about other activities. Reflective study practices enable students to think about their current study practices and identify strategies they can apply in order to improve how they study (Schon, 1987). By engaging in the text message-based instructions in these passive ways, participants were still able to become more aware about their own study practices and identify more efficient ways to study. Although participants reported that the text message-based instructions to study was able to increase their awareness about effective study strategies, in the absence of objective assessments of their self-regulated learning skills, it was not possible to identify if these participants were able to actually apply these strategies.

Studies have shown that assessments, where students are awarded marks for their participation and effort, tend to be one of the most effective motivator for students to engage in learning activities (Boud, et al., 1999; Nolen, 2011). Participation in this study was voluntary and the instructions sent to the students to improve their self-regulated learning were not integrated with any assessments or course content. The

findings of this study indicate that even though the study skills development program was not allocated any course marks, many participants were still willing to engage with the text message-based study supports, illustrating the effectiveness of study supports via mobile text message technologies.

8.2.3 By participating in the study skills development program, participants were able to improve their cognitive learning strategies of self-regulated learning skills.

The findings of this study indicate that by participating in this study skill development program, participants improved their self-regulated learning skills. These results were collected from participants self-reports, through the pre-activity and post-activity MSLQ, as well as the questionnaires and interviews. While there was evidence of improvement in self-regulated learning skills for most participants, the improvement observed for the targeted cognitive learning strategies of self-regulated learning was comparatively higher than the non-targeted strategies. Statistical t-tests carried out on each of the targeted self-regulated learning skills indicate that three out of the six cognitive learning strategies that were targeted, had a statistically significant improvement between the pre-activity post-activity MSLQ scores. Even though the improvement reported for the other three cognitive learning strategies were not statistically significant, the improvement was still more than the non-targeted cognitive learning strategies. These findings are similar to those from other studies that indicate that although some students can develop self-regulated learning skills by participating in the various learning activities as part of their enrolment in university subjects, most need explicit support to develop these skills (Dignath, Buettner, & Langfeldt, 2008; Torrano & Torres, 2004).

Participants indicated that these improvements in their self-regulated learning skills are more likely due to the strategies provided through the 'text' messages. The participants in this study indicated that they appreciated the fact that the supports were individually targeted and felt connected to them. They perceived that the messages were helpful and helped them develop their overall self-regulated learning skills. Even though this study depended on participants self-reported perceptions about their study behaviours and their abilities, which can be subjective and depends on student

remembering past events, it does provide a good indicator about how they perceive their own abilities (Bandura, 1994).

In sum, highly developed self-regulated learning skills are linked to better academic performance and lower attrition rates among first year university students (Cleary & Platten, 2013). The findings in this study for the first research question indicate that appropriately designed mobile learning can be effective in helping students develop their self-regulated learning skills. This is particularly important since the majority of first year university students, due to their previous study background, are not adequately prepared for independent study (Taylor, 2008). The findings are also timely since universities are increasingly encouraged to reduce their dependence on public funding, attract students from the low socio-economic sectors and reduce overall attrition rates of university students, making it even more difficult to provide effective study skills support to students (Oliver, 2007).

Universities need to explore strategies that provide individualised teaching and learning support to address the diversity in learning needs and styles encountered as a results of increased student numbers and enrolments from non-traditional, straight out of high school students (Chang, et al., 2003; Kukulska-Hulme, 2007; Laurillard, 2002). Generic study supports, although convenient, may not act effective for all students, and may end up leaving some students behind.

The cognitive learning strategies of self-regulated learning consist of six components: rehearsal, elaboration, organization, meta-cognition, time and space management and self-effort. Students usually demonstrate different levels of competencies in their ability to apply each of these components, for example some students may be very competent with rehearsal strategies but be extremely incompetent with organisation (Zimmerman, 2000). Different strategies exist to develop each of these cognitive learning strategies. Effective strategies to enable students to develop these cognitive learning strategies must recognise these differences between students and address the skills most in need for each student.

This study used the cognitive learning strategies of the Motivated Strategies Learning Questionnaire (MSLQ) to identify the self-regulated learning skill component that each student needed most help with (Pintrich, et al., 1991). This was the component in which the student was weakest in. Text messages, containing the strategies to improve the weakest components, were then sent to each student. This enabled the text messages to be individually targeted according to each student's need.

8.3 Key findings from research question 2: How does the use of mobile phone technology influence first year university students' engagement in learning outside class?

The findings of this study indicate that by using mobile phone technology, participants were able to report positive and high levels of engagement with learning outside class time. The findings further indicate that participants were receptive to the text message-based study support. The findings also indicate that the participants were willing and able to engage with the learning support and use the instructions provided to improve their study behaviours. The participants conveyed positive experiences receiving the text messages even when the messages were received at inconvenient times.

Participants in this study indicated that they fit in their study whenever and wherever they can, in between their various extra-curricular commitments. Often this would occur when the participants were commuting or waiting for transport. Participants also tend to focus more on working on assessment tasks, which may be considered a form of purposeful study, but they do not have enough time to focus on personal studying. On occasions when the participants do take time out to study, they tend to study at home or in places where they can be away from other students and people. Unfortunately, based on the findings of this research, participants often follow the study strategies that they are familiar with from previous study experiences, which in most cases do not reflect the study practices they should be employing in order to develop their self-regulated learning skills. The study skills development support that was provided to the students in this study enabled students to apply appropriate study strategies when they were attempting to study on their own. In some cases, the

participants had not planned to study, but started to study because of the text message prompts.

Although the findings of this study indicated that students like to fit in their study whenever they can find time to do so, they also tend to keep their social lives very separate from the academic lives. For example a number of participants clearly indicated that they do not study on weekends as they need to attend to social commitments. Also in many cases it would be difficult to engage students to study, for example when they are at work and sports. For various practical reasons, participants in this study maintain strong boundaries between their studies and non-study times. The text message prompts used in this study forced students to break down some of these boundaries, for example when students engaged in reflection about their current study practices. Participants were prompted to engage in study related activities during times when they would not normally study. Despite this, participants reported that they had an overall positive experience participating in this study.

Studies have shown greater level of engagement with mobile learning if the learning activities are more formal according on intent (Boud, Keogh, & Walker, 1985; Rapetti, et al., 2011). This reinforces earlier discussion that students are motivated and inclined to participate if learning activities are intentional and closely integrated with assessment tasks. The results of this study, however, indicate that participants were willing to engage with the learning activities even though it was not integrated with any assessment tasks. The activities in this study were fairly informal on both intent and structure. Participants were able to decide if and when they work on applying the strategies sent to them, and the study skills strategies were not part of any subject or course objective. Furthermore, since the text messages were sent at times when participants were likely to be involved in non-study related activities, it would normally be expected that they would find these text messages annoying and would lead them to opt out of the study, however participants actually reported that they found the text messages helpful and not annoying even when it was received at inconvenient times. They further reported that the text messages gave an impression that they were being cared for by the university generally, particularly by the

researcher and therefore they felt they needed to reciprocate that by at least working on their studies when it was more convenient for them to do that. They went on to confirm that the individualised nature of the text messages-based support, where each participants individual learning needs was targeted was one of the reasons they found the text messages engaging. Participants also reported that overall they had a very positive experience with the text message-based study support and would be willing to use similar strategies in their classes at a later stage when they themselves become teachers.

The findings of this study suggest that study skills support programs delivered using mobile phone technologies can be effective in helping university students develop their self-regulated learning skills. The findings also suggests that interrupting students using mobile phone text messages during their outside class times does not lead to unfavourable perceptions about mobile learning. However, the findings do indicate that it can be problematic to ensure students follow the text message-based instructions about appropriate study practices as soon as they receive the messages, particularly if the messages are received when students are engaged in activities like sports or work.

The study is significant as it adds to knowledge about effective ways to develop first year university students' independent study skills by participating in a self-regulated learning program delivered using mobile phone technologies. The findings of this study are timely given that first year university students struggle to cope with the demands of independent study. This study demonstrated a cost effective way to enable continuity of learning between inside and outside class learning using mobile phone technologies. The study was conducted with a cohort of first year Bachelor of Education students at the University of Wollongong, but the findings will be useful for all higher education institutions.

8.4 Implications for practice

Universities and other higher education institutions often assume the students will become independent learners by developing effective self-regulated learning skills implicitly just by being part of the teaching and learning programs, without needing to provide explicit strategies to help them develop into independent learners

(Zimmerman, et al., 1992). While it may be true that some students develop independent study skills over time, most can benefit from explicit strategies to help them develop these skills. In any case students always find it challenging to transition to a new learning environment and explicit study skills support would help to ease their transition a little (Torrano & Torres, 2004).

Recognising the importance of self-regulated learning skills for the development of independent learners and overall success at universities, a number of studies have implemented various programs to address these deficiencies in first year higher education students' study skills (Schunk & Zimmerman, 1998). Some studies also used mobile and other technologies to develop these skills with varying results (Goh, et al., 2012; Zurita & Nussbaum, 2007). This study developed a personalised study skills development program by identifying participants individual self-regulated learning skills need and then delivered the support prompts to the participants via text messaging to their mobile phone at different times of the day, including when some participants were involved in non-study related activities like work and sports. The findings of this study suggest that this type of application of mobile technologies for improving students' study skills can be beneficial for the students. However for effective implementation of this or similar independent study skills development program, attention should be drawn to the following aspects.

8.4.1 Increasing engagement

The study skills development program offered provided to students in this study is an example of a generalised support, which can and in-fact to be most effective, needs to be applied across all subjects by the students. Previous studies have suggested that in order for support programs to develop students study skills to be more effective, it needs to be integrated with assessments (Kift & Field, 2009; Rapetti, et al., 2011). Although integrating the mobile learning support strategies used in this study with assessments is likely to improve its effectiveness, however, given that the support programs identified and delivered in this study are generalist support, integrating it with a single assessment task can actually be counterproductive as students may inadvertently perceive the support to only apply to that particular subject.

Another option that may be explored to ensure greater motivation for students to participate in the learning strategies used in this study is to explore the possibility of offering this mobile learning activity to students as a generalist compulsory unit independent of course and subjects. This generalist study skills subject would not award any marks or grade, but students' results could be withheld for non-completion. Similar strategies have been employed for other study skills support programs (Cooper, 2011).

Future implementations of this mobile learning support to develop students self-regulated learning skills would need to be well informed by studies that evaluate the effectiveness of integrating this strategy with assessments or offering it as a generalist compulsory subject.

8.4.2 Sustained support

The timing of any support program that is aimed to help students improve their study skills is very important. The results of this study indicate that participants prefer to start receiving the support messages right from the beginning of their semester and continue until exam time. Although this study was implemented at the beginning of the semester, the support messages did not continue until exam time, participants indicated that they would prefer to receive support when they are busier with their studies preparing for end of semester exams, but also appreciate the importance of getting the support from the beginning of the course. Given the length of the semester, it can be more effective to offer students to complete the MSLQ midway through the semester to identify if their study needs have changed and therefore respond with relevant support messages.

8.4.3 Utilisation of advanced mobile technologies

For the purposes of this research study to provide effective support to develop students' self-regulated learning skills via mobile learning, an online survey was developed with the MSLQ questions and students' responses to these online questions was automatically collected and calculated according to the MSLQ manual using a custom software developed exclusively for this study (Pintrich, et al., 1991). This enabled the identification of each student's abilities against each of the six cognitive learning strategies of self-regulated learning. The weakest cognitive learning strategy

for each student was identified from the MSLQ calculation and manually entered into an online SMS gateway used to send bulk text messages to large number of students. All the text message prompts were scheduled to be sent automatically by the online SMS gateway.

Although the only costs incurred for this study was the sending of the text messages at about three cents per message, future implementation can be automated by taking advantage of students smartphones to develop the MSLQ as a mobile application ('app') to collect student responses, which can be sent to the university servers that host the custom software for calculation of the MSLQ responses to identify the weakest self-regulated learning skills component, and then this information passed on to an 'SMS gateway' to send all relevant text messages automatically.

8.4.4 Incorporating location-awareness

Some students in this study suggested that they would have preferred to receive the text message-based support at specific times and locations, for example, when they are ready to study at home. Enhancements for future implementations can take advantage of the location-awareness features of most smartphones to identify physical locations of students and send them text messages based on their location. For example if students study at home and prefer to receive study skills development support during that time, applications can be developed where the mobile phones recognises the student's locations and then sends text messages when students are at home. This could be configured to send text messages when students are at other study locations as well, like the library.

8.5 Implications for theory

Mobile learning can be defined as learning that occurs when the learner is mobile regardless of the technology (Shuler, 2009) or as learners using mobile devices to support their learning regardless of their location (McManus, 2002). Ubiquitous nature of mobile devices allow learning to be interwoven into everyday activities of students and therefore this study adopted the definition that mobile learning is done when the learner is mobile while using mobile devices to support their learning.

Given this definition of mobile learning, theories of mobile learning must also consider the learning that occurs outside of class. Unlike inside class learning activities where the teacher can have control over the learning activities that learners engage in, outside class learning is dependent on the learners initiating the learning activities (Sharples, et al., 2005). One of the challenges that educators face is the ability to design mobile learning activities that are engaging and meaningful for learners (Naismith, et al., 2004). Mobile learning activities that emphasises ‘anytime, anywhere’ learning, personalisation of learning, ability to engage diverse learners and use of familiar interaction modes of communication, is more likely to appeal to mobile learners.

8.5.1 Implications for formal and informal learning theories

Mobile learning has the potential to engage learners both inside and outside class environments. Discussions in the literature about mobile learning in these inside and outside class learning discuss how mobile learning crosses boundaries between formal and informal learning (Kukulska-Hulme, 2007; Sefton-Green, 2004).

Inside class learning is often referred to as formal learning and outside class learning is often referred to as informal learning (Sharples, et al., 2005; Wong & Looi, 2011). The literature review done for this research study indicated that the traditional and in commonly used definitions of formal and informal learning were not adequate. Formal and informal learning can be more effectively defined using the domains of *structure* and *intent* (Sefton-Green, 2004).

Structure refers to the physical environment where learning takes place, for example a formal learning according to structure is where the learning occurs in classrooms, schools and lecture theatres, whereas an informal learning according to structure is when the learning occurs outside of the physical built structures designed for learning, like the gardens and parks, where students are outside the classrooms. Most learning activities can be identified as existing on a continuum between completely informal and completely formal. For example when students start on a learning activity inside the classroom, and then move outside the classroom while still working on their learning activity that they started inside the classroom. In this example the learning

activity is neither absolutely formal nor absolutely informal, but contains aspects of both.

Formal and informal learning according to *intent* on the other hand refers to the degree of alignment of a learning activity to stated objectives of a course or subject that students are studying. For example, an informal learning according to intent will be where students learn whatever they wish to learn, without any stated objectives, like when adult learners use their mobile phones to search for content on the Internet, like how to change a car tire. An absolutely informal learning according to intent is often serendipitous. On the other hand a formal learning according to intent would be when students take part in learning activities explicitly designed by a teacher according to the stated objectives of the subject that they are enrolled in. Any learning activity can be placed on a continuum between absolutely informal and absolutely informal on intent. For example, when students work on a group project with explicit aims and objectives, they may also acquire unintentional skills like inter-cultural communications. In this example, the learning activity can then be classified as more formal on intent, also demonstrate aspects of informal learning as students are learning unintentional skills. Using these definitions of formal and informal learning according to intent and structure, all learning activities can be shown to demonstrate characteristics of both formal and informal learning according to intent and structure.

The literature on mobile learning contains rudimentary conceptualisations of formal and informal learning. As part of this research, a simple tool was devised by the researcher to more effectively analyse mobile learning activities to understand how it can be placed within the formal and informal learning continuum and therefore understand the implications on students' study experiences. This allowed effectively capturing the learning that occurs inside and outside the class, students' personal study, as well as serendipitous learning experiences, while still using the formal and informal learning conceptualisations. Each of the studies identified in the literature review was evaluated to identify how formal or informal they were according to intent and structure domains using a Likert type scale from one to ten, where one indicating absolutely informal and ten indicating absolutely formal.

This study helped students to apply effective study strategies by prompting them via text messages at various times of the day outside of their class times. The students were not obliged to follow any of the instructions and were able to apply the instructions in any subjects or any time that they found convenient. Analysing the mobile learning implementation of this study using the formal and informal learning evaluation tool⁵ used to evaluate all the other studies in the literature review indicates that this study was extremely informal on structure, as the participants were expected to engage in the study outside class and somewhat informal on intent, as the time, structure and motivations of the students could not be controlled, but the study strategies were still being applied to their subject content. Figure 2 indicates the evaluation of this study using the evaluation tool:

Structure	Informal	1	2	3	4	5	6	7	8	9	10	Formal
Intent	Informal	1	2	3	4	5	6	7	8	9	10	Formal

Figure 24: Formal and Informal Learning Evaluation of Current Study

Understanding where a mobile learning activity sits on the formal and informal learning continuum can help conceptualise the type and level of engagement by the learners. This evaluation tool can be used to evaluate other similar studies where mobile technologies are used to engage learners across formal and informal learning environments.

8.5.2 Implications for theories of mobile learning

Mobile learning theories emphasise the importance of recognising the considerable amount of learning that occurs outside the classroom (Sharples, 2005, Vavoula, 2005). Indeed this study also highlighted that the majority of the ‘personal’ study activities by the participants was done outside class. However, it is also interesting to note that although students engage in learning activities outside class, they are less likely to engage in the learning activities when then are mobile, that is, when they are commuting to and from home and university (Vavoula 2005).

⁵ This evaluation tool is explained in Chapter 2

Appropriate theories of mobile learning then should aim to engage students in learning activities when they are outside class as well as suitably located to engage in mobile learning activities.

8.6 Limitations of the study

It is important to acknowledge the study's limitations, as certain aspects of this study may have affected the findings and interpretations of the data. Aspects of the dataset, context of the study and measurement of the study skills presented certain limitations and are discussed here:

8.6.1 Limitations of the dataset

This study collected data from a pre-study and a post-study MSLQ questionnaire, an end-of-study questionnaire and an end-of-study face-to-face interview. The study was completely voluntary at every stage, that is, students were able to opt out of the study at any time, and choose not to complete any of the questionnaires or participate in the interviews. Out of a total of 140 students who volunteered to participate, 2 opted out of the study and did not receive any further support. The reasons for these two opting out are not known, however, it would have been informative to seek their feedback before removing them from the study.

Similarly, only 69 students completed the post-participation MSLQ and the end-of-study questionnaire. The other 68 (taking into account the 2 who opted out) did not complete any post-study feedback even though they did not opt out of receiving the text messages. For these students the only data available for analysis was the pre-study MSLQ scores, which has been analysed and reported in the results sections of this thesis.

The findings of this study are based on participants self-report about their study practices and experiences through the MSLQ questionnaire, the end-of-study questionnaire and an end-of-study interview. Self-reports depend on participants remembering all the events, experiences and their interpretations of their participation during the study. Depending on their memory to recall past events, it can limit the validity of the data they provide (Veenman, 2011). In this research, data from different sources was triangulated to confirm the results and understand the study

behaviours of students. Data about students' outcomes and achievements in various subject assessment instruments was not collected in this study, which would have provided greater insight into students' ability to apply the study skills introduced in this study.

8.6.2 Limitations within the context

This study was implemented with students enrolled in an introductory educational technology subject in the Bachelor of Education degree programs at the University of Wollongong. This subject aims included introducing students to various educational tools that they could use in their own teaching practices after graduating. Due to this context, the participants in this study were aware about the significance of technology use to enhance learning and were interested in the implementations of this study, as a learning experience for their own practice at a later time. The findings of this study indicate that the study was beneficial for the participants of this study, it is inconclusive about the impact of using similar strategies to develop effective study skills for students in other programs of university who are not overtly aware about, where the relationship between educational technology and students learning outcomes. Similarly, the results might be different if the students are not inherently interested in understanding mobile learning implementations as a learning exercise for their own future practices.

8.6.3 Limitations with the measurement of self-regulated learning skills

There are a number of ways in which students' self-regulated learning can be measured, which includes interviews, self-reports, questionnaires, students real-time work samples, etc. This study used MSLQ and students' self-reports in the form of a questionnaire and interviews. These methods can be reliable and have been widely used in previous studies (Garcia, et al., 1993; Goh, et al., 2012; Santarosa, 2011), and triangulating data from multiple sources, as was done in this study, improves the validity of the data. However, all of these methods depend on students remembering previous events and situations when they were studying, and it is possible that their interpretations are inaccurate at the time that they provide their responses.

Another source of data that could add to the understanding about students' development of self-regulated learning would be the real-time work traces of

students' activities (Winne, 2014). This can only be provided if the entire learning activity is development and implemented using online learning management systems and other integrated technology tools.

8.6.4 Limitations with the accuracy of data due to rapport and friendship

Once the participants agree to be part of a study, the researcher develops a rapport with the participants in order to get them to disclose information (Denzin & Lincoln, 1998). The design of this research might have been influenced by the participants' perceived rapport and friendship with the researcher as some participants indicated that they "felt cared for" (Arti, face-to-face interview). Participants might have felt obliged to only provide positive feedback about their participation in order to reciprocate the 'favour'.

8.7 Further research

This study has highlighted a number of opportunities for further research in supporting the development of students' study skills through mobile technologies.

This study was conducted over a six week period to help students develop their self-regulated learning skills by prompting participants to practice effective study strategies identified using the Motivated Strategies Learning Questionnaire (MSLQ) (Pintrich, et al., 1991). The results indicate that the strategies used in this study were effective in developing students' self-regulated learning skills over this six week period. Self-regulated learning skills have been identified by various studies as an essential set of skills for long term success at university studies (Nisbet, 1991). More research is therefore required to observe the impact of similar strategies to develop study skills on students' long term attrition rates at university. Future studies would be well placed to use the findings from this and other similar studies to observe students over a three or four year period (Chang, 2005; Cleary & Platten, 2013; Goh, et al., 2012; Kondo, et al., 2012). Further studies could extend this research investigating the impact of self-regulated learning skills development program on students' long term attrition rates.

Research could also explore the actions of students that lead to most optimal development of self-regulated learning skills. It was beyond the scope of this study to

seek information about the actual actions of participants when they received the text message prompts. The findings of this study indicate that students do tend to follow the instructions, either immediately or think about the instructions about effective study subconsciously. It was however not possible to know which actions were more effective. The act of subconsciously registering the study processes in memory may be effective in embedding effective study practices to be applied in all study situations. On the other hand, consciously following the instructions when students are ready to study may lead to more positive outcomes. Students are more likely to follow the instructions immediately if the prompts are received when they are ready to study during their formal study times, whereas they are more likely to engage with the messages subconsciously if the messages are received during the non-study, informal times. Therefore further research needs to be conducted to seek the differences in the development of self-regulated learning skills between formal and informal times.

Understanding the most optimal combinations of self-regulated learning skills components to develop is another aspect worthy of further research. Self-regulated learning skills include a number of components including rehearsal, elaboration, organization, meta-cognition, time and space and self-effort. The results of this study show that while targeting the most needed self-regulated learning skills, participants were also able to improve their other self-regulated learning skills components, however the results highlight that the percentage of improvement of the non-targeted skills components varied, that is, there were some targeted skills that facilitated the most improvement in other skills. Further research is needed to understand the relationship between the different self-regulated learning components, and how the development could be targeted more effectively to facilitate the greatest improvement in not just the targeted skill but the whole range of the self-regulated learning skills components.

Further research in this area could also explore the implications of a study skills development strategy like the one used in this study on students learning outcomes and learning processes. The instruments used in this study enabled participants to indicate that their self-regulated learning skills had improved as a result of their participation in this study. More effective understanding about this or similar

programs can be gained by analysing students' performance in examinations and other assessments, as well as looking at the study processes used by the students. Technical developments in the use of online traces of student data about their participations with learning activities would enable future researchers to make more informed conclusions about the impact of strategies to develop students self-regulated learning skills on learning outcomes (Johnson, et al., 2014; Winne, 2014).

With recent and future advances in mobile technologies, including location awareness and seamless integration with online data sources, other areas that could be explored for further research could include the utilization of emerging technologies in gamification, the quantifiable self and virtual assistants to help students develop effective study skills (Johnson, et al., 2014). Gamification involves using the game technology in educational settings. Aspects of gamification can be useful in study skills development where students can be required to do through various game-type strategies that enable students to implicitly develop effective study skills (Kondo, et al., 2012). Various forms of rewards and other incentives can be used to motivate students to participate in these game-based activities. Quantifiable self includes a collection of technologies that allow students to monitor their performance and progress in real-time, and make adjustments to optimize their study skills development. Some of the types of things that could be monitored to enhance their learning skills development may include the location, duration, collaboration with others, and other similar data from real-times and online sources. Virtual assistants are aspects of mobile apps that can provide guidance to students about what they should do, based on data from various educational sources. It can be utilised for the development of effective study skills by integrating with quantifiable self and gamification applications to guide students with the most effective strategies to use for different situations, locations and subject topics.

8.8 Conclusion

This study makes significant contribution towards knowledge about developing first year university students' independent study skills by using a self-regulated learning skills development program delivered using mobile phone technologies. The study was implemented using appropriate mobile phone technologies to interrupt students during their outside class times.

The results also show that even though some students received the text messages when they were busy with work or carer duties, they were able use the instructions contained in the text messages to increase their awareness about effective study strategies. The findings of the study also highlighted that it can be problematic to engage participants to follow the instructions to study when they were busy with other activities. Some of the reasons for not engaging is reported as the study skills development program was impinging on their personal time, the study did not have any assessable value and that the instructions were too 'common sense'.

Mobile phones provide a cost-effective and feasible medium for the development of individualised study skills. Universities do not require large investments in personnel and infrastructure to provide this type of essential study skills support. Successful implementation can lead to reducing attrition rates among university students by improving the ability of student to cope with the demands of independent learning at universities and other similar higher education institutions.

9 References

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10 Appendices

10.1 Appendix A: Ethics Approval Form

**INITIAL APPLICATION APPROVAL**

In reply please quote: HE08/315
Further Enquiries Phone: 4221 4457

24 December 2008

Mr P Anand
Wollongong College Australia
Building 30

Dear Mr Anand

Thank you for your response dated 15 December 2008 to the HREC review of the application detailed below. I am pleased to advise that the application has been approved.

Ethics Number: HE08/315

Project Title: Investigate how the location-aware feature of wireless mobile devices could be used to support collaborative and reflective learning

Researchers: Mr Pranit Anand, A/Prof Anthony Herrington, Dr Shirley Agostinho

Approval Date: 18 December 2008


Expiry Date: 17 December 2009

The University of Wollongong/SESIAHS Humanities, Social Science and Behavioural HREC is constituted and functions in accordance with the NHMRC *National Statement on Ethical Conduct in Human Research*. The HREC has reviewed the research proposal for compliance with the *National Statement* and approval of this project is conditional upon your continuing compliance with this document. As evidence of continuing compliance, the Human Research Ethics Committee requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

You are also required to complete monitoring reports annually and at the end of your project. These reports are sent out approximately 6 weeks prior to the date your ethics approval expires. The reports must be completed, signed by the appropriate Head of School, and returned to the Research Services Office prior to the expiry date.

Yours sincerely


PP A/Professor Steven Roodenrys
Chair, Human Research Ethics Committee

cc A/Professor A Herrington, Faculty of Education

The title of the thesis and the supervisor had to be changed due to the unexpected departure of one of the research supervisors.

10.2 Appendix B: Main Study Information and Consent Form

PARTICIPATION INFORMATION SHEET FOR STUDENTS

Dear student,

You are invited to participate in a project titled “Using mobile wireless technologies to promote effective learning across formal and informal spaces in higher education”. It is designed to help develop your self-regulation learning skills as first year university students, using the web and mobile SMS technologies. This study will be conducted over a 10-week period in EDIC101: Learning and Teaching with Technology. Your participation is completely voluntary, however, by participating you will enable us to better understand the effectiveness of using SMS technology to promote effective learning strategies, and you will also gain an insight into educational research and enquiry, which could be useful for your own research interests as you progress through your studies.

INVESTIGATORS

Pranit Anand
Faculty of Education
02-42528992

Dr. Shirley Agostinho
Faculty of Education
02-42215512

A/Prof. Sue Bennett
Faculty of Education
02-42215738

WHAT WE WOULD LIKE YOU TO DO

If you choose to participate in this study, you will be requested to complete and sign the consent form indicating your intention to participate. The study begins in the week 3 tutorials and continues until week 10. You may participate in this study in any one of the following ways:

1. **You may choose to receive the learning support in the form of SMS prompts only.** For this you will be required to complete a 20-minute online questionnaire and provide us with your name and mobile phone number. We will use your responses to this questionnaire to send you 10 SMS prompts designed to help you develop your learning skills. You will also be expected to send in 2 SMSs to the researchers between week 4 and week 10. In week 10 tutorial you will be required to complete another 20-minute online questionnaire to gauge if you managed to improve your learning skills. Your name and mobile phone number will only be used for this purpose, and will be deleted at the completion of the study. We will not collect any other information or data from you, or
2. **You may choose to receive the learning support in the form of SMS prompts, provide us with your study notes and complete the 15-minute paper-based questionnaire.** For this you will be required to complete a 20-minute online questionnaire and provide us with your name and mobile phone number. We will use your responses to this questionnaire to send you 10 SMS prompts designed to help you develop your learning skills. You will also be expected to send in 2 SMSs to the researchers between week 4 and week 10. In week 10 tutorial you will be requested to provide copies of your study notes for this activity, complete a 15-minute paper-based questionnaire and complete another 20-minute online questionnaire. We will need to identify you in your study notes and the paper-based questionnaire so that we can triangulate data. Your name and mobile phone number will only be used for this purpose. All your personal details will be deleted at the completion of this study and you will not be identified or reported in any of the publications resulting from this study, or
3. **You may choose to receive the learning support in the form of SMS prompts, provide us with your study notes, complete the 15-minute paper-based questionnaire and agree to participate in a 30-minute face-to-face interview at a convenient time.** For this you will be required to complete a 20-minute online questionnaire and provide us with your name and mobile phone number. We will use your responses to this questionnaire to send you 10 SMS prompts designed to help you develop your learning skills. You will also be expected to send in 2 SMSs to the researchers between week 4 and week 10. In week 10 tutorial you will be requested to provide copies of your study notes for this activity, complete a 15-minute paper-based questionnaire,

complete another 20-minute online questionnaire and agree to participate in a 30-minute face-to-face interview. We will need to identify you in your study notes, the paper-based questionnaire and the interview so that we can triangulate data. Your name and mobile phone number will only be used for this purpose. All your personal details will be deleted at the completion of this study and you will not be identified or reported in any of the publications resulting from this study.

You are free to decide if you want to participate or not, and you can stop participation at anytime. If you do decide to stop participating, any information you may have provided will not be used. In any case all your personal details will be deleted at the end of the study and will not be shared with other organisations or individuals. All data collected will only be used for the purposes of this study and you will not be identified in any reporting of the finding. Your decision to participate or not will have no adverse effects on you in your treatment and assessment in EDIC101.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you are not happy with the way this research has been conducted, you can contact the Ethics Officer at the University on (02) 42214457.

**CONSENT FORM FOR UNIVERSITY STUDENTS****Using mobile wireless technologies to promote effective learning across formal and informal spaces in higher education**

Researchers: Pranit Anand, Dr. Shirley Agostinho and A/Prof. Sue Bennett

I have been given information about “Using mobile wireless technologies to promote effective learning across formal and informal spaces in higher education” and I have discussed this research project with Pranit Anand, the Chief Investigator of this study. I have also had an opportunity to ask Pranit Anand any questions I may have about the research and my participation.

I understand that my participation in this study is voluntary and that I am free to refuse to participate and I am free to withdraw my participation in this study at any time. My refusal to participate or withdrawal of consent will not affect my relationship with the University of Wollongong, or affect assessment in the subjects in any way. Based on the information provided to me about this study, I consent to participate in the study in the following way:

☐ Yes, I want to receive the learning support but I do not wish to provide any other data. *You will be required to complete a 20-minute online questionnaire and provide us with your name and mobile phone number. We will use your responses to this questionnaire to send you 10 SMS prompts designed to help you develop your learning skills. You will also be expected to send in 2 SMSs to the researchers between week 4 and week 10. In week 10 tutorial you will be required to complete another 20-minute online questionnaire to gauge if you managed to improve your learning skills. Your name and mobile phone number will only be used for this purpose, and will be deleted at the completion of the study. We will not collect any other information or data from you.*

☐ Yes, I want to receive the learning support and I am happy to provide my study notes and complete the paper-based questionnaire. *You will be required to complete a 20-minute online questionnaire and provide us with your name and mobile phone number. We will use your responses to this questionnaire to send you 10 SMS prompts designed to help you develop your learning skills. You will also be expected to send in 2 SMSs to the researchers between week 4 and week 10. In week 10 tutorial you will be requested to provide copies of your study notes for this activity, complete a 15-minute paper-based questionnaire and complete another 20-minute online questionnaire. We will need to identify you in your study notes and the paper-based questionnaire so that we can triangulate data. Your name and mobile phone number will only be used for this purpose. All your personal details will be deleted at the completion of this study and you will not be identified or reported in any of the publications resulting from this study.*

☐ Yes, I want to receive the learning support and I am happy to provide my study notes, complete the paper-based questionnaire and participate in a face-to-face interview. *You will be required to complete a 20-minute online questionnaire and provide us with your name and mobile phone number. We will use your responses to this questionnaire to send you 10 SMS prompts designed to help you develop your learning skills. You will also be expected to send in 2 SMSs to the researchers between week 4 and week 10. In week 10 tutorial you will be requested to provide copies of your study notes for this activity, complete a 15-minute paper-based questionnaire, complete another 20-minute online questionnaire and agree to participate in a 30-minute face-to-face interview. We will need to identify you in your study notes, the paper-based questionnaire and the interview so that we can triangulate data. Your name and mobile phone number will only be used for this purpose. All your personal details will be deleted at the completion of this study and you will not be identified or reported in any of the*

publications resulting from this study.

If I have any enquiries about the research, I can contact Pranit Anand on (02) 42458992. If I have any concerns or complaints regarding the way the research is or has been conducted, I can contact the Ethics Officer, Human Research Ethics Committee, University of Wollongong on (02) 42214457.

By signing below I am indicating my consent to participate in the research according to my option above. I understand that the data collected from my participation will be used for academic publication and I consent for it to be used in that manner.

Signed

Date

...../...../.....
Name (please print)

.....

10.3 Appendix C: Past year exam questions

For Early Years Students Only

Integrating Technology Appropriately

Think how technology can be integrated in these activities to enhance the learning outcomes.

Using at least one of the outcomes/activities, in no more than one page, explain:

- a.) What learning theory you would use as the basis for your approach and why it is appropriate.
- b.) What technology you would integrate and why it is appropriate.

Area of Development: *Understanding sequencing, logical order and succession of events*

Outcome: *Identifying beginning, middle, and end of a story*

Activity:

- *Ann reads a simple story to children and asks them to retell it to her. She prompts children for logical sequencing by asking, "What happened next?" She helps them to wrap it up by asking, "How did it end?"*

Outcome: *Developing a sequenced vocabulary, eg first, then, next, in the morning, before, after, while, finally*

Activity:

- *Tania takes three pieces of paper and tapes them together, creating one long poster with three distinct sections. She explains to children that the day follows a sequence: first comes morning, then afternoon, then evening. Then Tania asks children to describe some of the things that they do at each time of day. She offers suggestions if needed. Then she asks children to find pictures in magazines that illustrate different times of day. They cut the pictures and glue them on the relevant sections of the poster.*

FOR PHYSICAL AND HEALTH EDUCATION STUDENTS ONLY
Integrating Technology Appropriately

Read the excerpt from the Personal Development, Health and Physical Education syllabus below.

Think about how you would design a lesson integrating technology that addresses at the outcomes listed.

In no more than one page, explain:

- What learning theory you would use as the basis for your approach and why it is appropriate.
- What technology you would integrate, how learners would use it and why it is appropriate.

Syllabus Excerpt: Personal Development, Health and Physical Education, 7-10 Syllabus, 2003, p.23)

Strand 1: Self and Relationships

Stage 4

Outcome: 4.3 A student describes the qualities of positive relationships and strategies to address the abuse of power.

Students learn about:

bullying and harassment

*recognizing bullying and harassment
 reasons for bullying and harassment
 sexual harassment
 homophobic bullying
 effects of bullying and harassment
 barriers to reporting*

Students learn to:

*recognize forms of bullying and harassment, including sex-based harassment, and devise help-seeking strategies
 describe ways that they could help others who are being harassed, eg assist them to seek help, offer friendship*

Source: Board of Studies. (2003). Personal Development, Health and Physical Education, 7-10 Syllabus. Sydney, NSW: Board of Studies.

FOR PRIMARY STUDENTS ONLY

Integrating Technology Appropriately

Read the excerpt from the K-6 Science and Technology syllabus below.

Think about how you would design a lesson integrating technology that addresses the outcome listed and at least one of the selected indicators shown.

In no more than one page, explain:

- a.) What learning theory you would use as the basis for your approach and why it is appropriate.
- b.) What technology you would integrate, how learners would use it and why it is appropriate.

Syllabus Excerpt: Science and Technology K-6 Outcomes and Indicators (Board of Studies, 2006, p.45)

Products and Services Outcomes and Indicators

Stage 1

Outcome: PS S1.5 Grows, makes or processes some products using a range of techniques and materials.

Selected indicators:

- observes and records stages in the growth of alfalfa sprouts and predicts how different conditions might affect growth*
- designs and makes a present after sharing ideas with others and consulting books, CD-ROMs and/or bookmarked websites*
- uses a digital/reflex camera to record images of products, eg textile designs, food/ water carriers, didgeridoos, made and used by Aboriginal people and asks questions of an expert*

Source: Board of Studies. (2006). Science and Technology Outcomes and Indicators. Sydnev. NSW: Board of Studies.

10.4 Appendix D: Preliminary Study Student Survey

1. How would you rate your experience of receiving SMSs for study purposes?

Not helpful at all	1	2	3	4	5	6	7	8	9	10	Extremely helpful
--------------------	---	---	---	---	---	---	---	---	---	----	-------------------

Comments:

2. Do you think that getting SMSs helped you to revise your assigned topic?

☐ Yes

☐ No

Comments:

3. You received some SMSs on weekends and some on weekdays, which ones were more useful in terms of getting you to think about the topic?

☐ Weekends

☐ Weekdays

Comments:

4. What time ranges do you think is appropriate to receive the SMSs?

☐ 9.00am to 11.00am

☐ 11.00am to 3.00pm

☐ 3.00pm to 6.00pm

☐ 6.00pm to 9.00pm

☐ 9.00pm to 10.30pm

Comments:

-
-
5. Do you think that receiving SMSs for study purposes has been disruptive to your normal work/life/leisure activities?

Not at all	1	2	3	4	5	6	7	8	9	10	Very disruptive
------------	---	---	---	---	---	---	---	---	---	----	-----------------

Comments:

6. To what extent did getting the SMS prompts engage to act on the requests?

Not at all	1	2	3	4	5	6	7	8	9	10	Always
------------	---	---	---	---	---	---	---	---	---	----	--------

Comments:

7. To what extent did getting the SMS prompts engage to think about the requests, even if you were unable to act on them?

Not at all	1	2	3	4	5	6	7	8	9	10	Always
------------	---	---	---	---	---	---	---	---	---	----	--------

Comments:

10.5 Appendix E: Preliminary Study Text Messages

Table 1: Schedule of text messages sent

Week	SMS: – purpose and text	Day and time sent
Week 8	Introduce the study partner to the students. <i>“Your group partner is Contact details are: Mobile number, email address”</i>	Monday morning
Week 8	Inform students of the availability of the revision question online <i>“You have a question available online at www...”</i>	Monday afternoon
Week 9	Prompt students to contact their nominated study partners. <i>“Have you contacted your study partner yet? Find a suitable time/place to go through the revision question”</i>	Monday morning & Tuesday evening
Week 9	Seek feedback from students about how they are going with the activity so far. <i>“Please SMS a short reflect about how do you feel about this activity so far?”</i>	Thursday afternoon
Week 9	Remind students to continue with the activity. <i>“Find a suitable time/place to revise the question with your study partner.”</i>	Saturday afternoon
Week 10	Remind students to bring in their study notes to the tutorials and be prepared for a short survey. <i>“This activity is getting to a close. Pls bring in yur study notes 2 the tute next week & b ready 4 a survey”</i>	Wednesday evening

10.6 Appendix F: Main Study Text Messages

SMS Prompts to develop the six identified scales of Learning Strategies associated with Self-regulation

The prompts that the students will get via SMS will reflect the suggestions for developing the scales for learning strategies that students need most help with. The SMS gateway will be programmed to send out these prompts based on the scores of the pre-activity MSLQ. These prompts have been adopted from the MSLQ Manual (Pintrich, Smith, Garcia & McKeachie 1991) suggestions for developing the scales.

1. Rehearsal: This scale is a measure of how often students use study strategies such as rereading class notes and course readings and memorizing lists of key words and concepts. This strategy could be developed using the following prompts:
 - a. Start creating a glossary of important terms and topics in the course.
 - b. Define these terms and repeat them out loud.
 - c. As this list grows bigger, divide it into smaller lists of related items. Make up images, rhymes etc, to help you remember these terms.
 - d. Test yourself by generating a quiz from these lists.
2. Elaboration: This scale reflects how students attempt to summarise or paraphrase the material read in textbooks and how to relate to the material read. This strategy could be developed using the following prompts:
 - a. Paraphrase and summarise important information.
 - b. Use your own words to describe material covered during lecture/readings.
 - c. Try to figure out how each topic relates to the other.
 - d. What are the connections between the topics.
3. Organisation: This scale refers to the students' ability to select the main ideas from readings as well as attempt to organise and put together what they have learnt in the course. This scale could be developed using the following prompts:
 - a. Outline course materials.
 - b. Identify where text/readings and lectures overlap.
 - c. Develop connections between ideas.
 - d. Make charts/visual aids to help you understand how ideas connect.
4. Meta-cognition: This is a measure of how often students think about what they are reading or studying. This scale could be developed using the following prompts:
 - a. Skim the reading materials before you begin to see how it is organised.
 - b. While reading ask yourself questions about the paragraph you have just read and scribble key words.
 - c. Try to determine which concepts you don't understand well.
 - d. Attempt to find out about these difficult concepts.
5. Time and study space: This is a measure of how well students manage time and schedule, and use appropriate place to study: This scale could be developed by the following prompts:
 - a. Write down your goals for each week.
 - b. Write down what you have actually accomplished.
 - c. Analyse your goals and what you have accomplished.
 - d. Adjust the goals, place of study, times, when and whom you study with.

6. Self-effort: This scale refers to students' willingness to try hard to study, even when the work is difficult. This scale could be developed by the following prompts:
- a. Keep a list of topics that you find procrastinating instead of studying for it.
 - b. Discuss why you think you tend to postpone studying these topics with another student.
 - c. Can you identify alternate strategies to ensure you do study these topics?
 - d. Apply these alternate strategies for these topics.

10.7 Appendix G: Main Study Student Questionnaire

Student end of study questionnaire

The questions below relate to your experience with receiving the 10 SMSs relating to this study.

Your answers to these questions will help me understand how SMSs could be used as a tool to support learning in higher education.

Please note that your personal details will not be shared with anyone, and you will not be identified in any of the publications resulting from this study.

1. Please enter your name

2. Enter the mobile number you used to sign up for this study

3. What do you normally use your mobile phone for?

(Choose as many as are relevant)

☐ What do you normally use your mobile phone for? (Choose as many as are relevant) Email

☐ SMS

☐ Voice communication

☐ Alarm

☐ Internet access

☐ Calender

☐ Reminders

☐ Clock

☐ Other (please specify)

4. Since starting university, when do you prefer to study? (Choose as many as are relevant)

☐ Since starting university, when do you prefer to study? (Choose as many as are relevant) Weekdays

☐ Weeknights

☐ Weekends - day time

☐ Weekends - night time

Explain why?

5. How do you normally study? (Choose as many as are relevant)

- ☐ How do you normally study? (Choose as many as are relevant) On my own
- ☐ With my friends
- ☐ With a study group (that does not include friends)
- ☐ Other (please specify)

6. Where do you mostly like to study? (Choose as many as are relevant)

- ☐ Where do you mostly like to study? (Choose as many as are relevant) At home
- ☐ On campus
- ☐ At a friend's house
- ☐ At work
- ☐ Other (please specify)

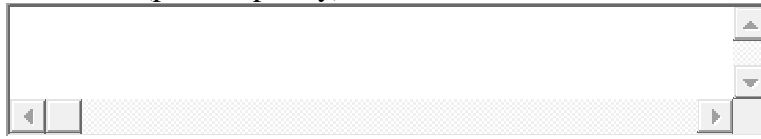
7. Which of the following technologies do you use to help you with your studies?
(E.g. working on assignments, finding out more about ideas covered in class,
checking your understanding, etc.)

(Choose as many as are relevant)

☐ Which of the following technologies do you use to help you with your studies?
(E.g. working on assignments, finding out more about ideas covered in class,
checking your understanding, etc.) (Choose as many as are relevant) UOW
eLearning space

- ☐ UOW Library website
- ☐ Email
- ☐ Facebook
- ☐ Wikipedia
- ☐ Google scholar
- ☐ Mobile phones

☐ Other (please specify)



8. How would you rate your overall experience of receiving SMSs for study purposes?

(Please note that 1 is not helpful at all, and 10 is extremely helpful?)

	1	2	3	4	5	6	7	8	9	10
--	---	---	---	---	---	---	---	---	---	----

Please comment about how the SMSs helped or did not help with your studies:



9. Do you think that receiving SMSs helped you to improve your study skills?

- ☐ Do you think that receiving SMSs helped you to improve your study skills? Yes
- ☐ No
- ☐ Not sure



Please explain why:

10. Did receiving SMSs disrupt your work/life/leisure activities?

(Please note that 1 is not at all disruptive and 10 is extremely disruptive)

	1	2	3	4	5	6	7	8	9	10
--	---	---	---	---	---	---	---	---	---	----

Please explain how it has been or not been disruptive:

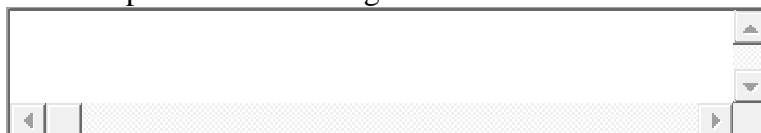


11. Was it useful to receive SMSs about your university studies outside class times?

(Please note that 1 is not useful at all and 10 is extremely useful)

	1	2	3	4	5	6	7	8	9	10
--	---	---	---	---	---	---	---	---	---	----

Please explain how receiving SMSs has been useful or not:



12. What did you do when you received an SMS message?

(Choose as many as are relevant)

- ☐ What did you do when you received an SMS message? (Choose as many as are relevant) Read and acted on it straight away
- ☐ Read and followed the instructions later
- ☐ Dismissed it initially, but followed the instructions when I had more time later
- ☐ Read but did not follow the instructions at all
- ☐ Dismissed the messages completely
- ☐ Other, please explain



13. Did you refer back to the SMSs at a later time when you were studying and revising?

- ☐ Did you refer back to the SMSs at a later time when you were studying and revising? Yes
- ☐ No
- ☐ Sometimes

Please explain why?



14. Please comment on your overall experience of receiving SMSs for study purposes:



Please comment on your overall experience of receiving SMSs for study purposes:

Thank you very much for participating in this study.

10.8 Appendix H: Main Study Interview Questions

Sample interview questions

1. Tell me a little bit about yourself. Your high school, work, hobbies, etc?
2. What do you think about university study requirements compared to high school study requirements?
3. How did you study when you were in high school?
4. How do you study now that you are at university?
5. Where do you normally study?
6. Do you study on your own or with someone, explain why?
7. How do you use your mobile phone?
8. What types of messages did you receive from me, did you understand them all?
9. Did you refer to the messages afterwards?
10. What do you think about using SMSs for study? Would you be able to describe some examples of what were you doing when you received the SMSs and how you acted.
11. Did you apply the instructions to other subjects?
12. You might have received some SMSs at inconvenient times like in a lecture or while at work, etc. How did you attend to these SMSs? Were you able to start thinking about what you needed to do even though you were not actually able to do what was suggested?
13. The SMSs were designed to encourage you to act in certain ways. Do you think that these SMS messages did in fact engage you to think and act in the way suggested.
14. Overall, do you think that the SMSs promoted you to be thinking or working on study related tasks more than if you had not received them.
15. Would you like this type of SMS support expanded to other subject or discipline areas?
16. Do you use facebook or other social media on your mobile phones? How would you feel if the support messages were sent via facebook or other social media that you use?

10.9 Appendix I: MSLQ Questionnaire

Part B. Learning Strategies

The following questions ask about your learning strategies and study skills for this semester. Again, there are no right or wrong answers; just answer as accurately as possible. Answer the questions about how you study in your classes as accurately as possible. Use the same scale to answer the remaining questions. If you think the statement is very true of you, fill in the circle on 7; if a statement is not at all true of you, fill in the circle on 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you.

(Pintrich, P., Smith, D., Garcia, T., & McKeachie, W. (1991))

32. When I study the readings for my classes, I outline the material to help me organize my thoughts.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

33. During class time, I often miss important points because I'm thinking of other things.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

34. When studying for my classes I often try to explain the material to a classmate or friend.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

35. I usually study in a place where I can concentrate on my class work.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

36. When reading for my classes, I make up question to help focus my reading.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

37. I often feel so lazy or bored when I study for my classes that I quit before I finish what I planned to do.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

38. I often find myself questioning things I hear or read in my classes to decide if I find them convincing.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

39. When I study for my classes, I practice saying the material to myself over and over.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

40. Even if I have trouble learning the material in my classes, I try to do the work on my own, without help from anyone.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

41. When I become confused about something I'm reading in class, I go back and try to figure it out.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

42. When I study for my classes, I go through the readings and my class notes and try to find the most important ideas.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

43. I make good use of my study time for my classes.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

44. If class readings are difficult to understand, I change the way I read the material.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

45. I try to work with other students from my classes to complete the course assignments.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

46. When studying for my classes, I read my notes and course readings over and over again.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

47. When a theory, interpretation or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

48. I work hard to do well in my classes even if I don't like what we are doing.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

49. I make simple charts, diagrams, or tables to help me organize course material.

<input type="radio"/> 1. Not	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true
------------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	------------------------------------

at all true of me						of me
-------------------------	--	--	--	--	--	-------

50. When studying for my classes, I often set aside time to discuss course material with a group of students from the class.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	---

51. I treat course material as a starting point and try to develop my own ideas about it.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	---

52. I find it hard to stick to a study schedule.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	---

53. When I study for a class, I pull together information from different sources, such as lectures, readings and discussions.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	---

54. Before I study new course material thoroughly, I often skim it to see how it is organized.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	---

55. I ask myself questions to make sure I understand the materials I have been studying in class.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	---

56. I try to change the way I study in order to fit the course requirements and the instructor's teaching style.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

57. I often find that I have been reading for my classes but don't know what it was all about.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

58. I ask the instructor to clarify concepts I don't understand well.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

59. I memorize key words to remind me of important concepts in class.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

60. When course work is difficult, I either give up or only study the easy parts.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

61. I try to think through a topic to decide what I am supposed to learn from it rather than just reading it over when studying for my classes.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

62. I try to relate ideas from one course to those in other courses whenever possible.

<input type="radio"/> 1. Not	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true
------------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	------------------------------------

at all true of me						of me
-------------------------	--	--	--	--	--	-------

63. When I study for a course, I go over my class notes and make an outline of important concepts.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--

64. When reading for class, I try to relate the material to what I already know.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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65. I have a regular place set aside for studying.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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66. I try to play around with ideas of my own related to what I am learning in my classes.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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67. When I study for a course, I write brief summaries of the main ideas from the readings and my class notes.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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68. When I can't understand the material in a course, I ask another student in class for help.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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69. I try to understand the material in class by making connections between the readings and the concepts from the lectures.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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70. I make sure that I keep up with the weekly readings and assignments for my courses.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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71. Whenever I read or hear an assertion or conclusion in class, I think about possible alternatives.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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72. I make lists of important items for each class and memorize the lists.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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73. I attend class regularly.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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74. Even when course materials are dull and uninteresting, I manage to keep working until I finish.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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75. I try to identify students in class whom I can ask for help if necessary.

<input type="radio"/> 1. Not	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true
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at all true of me						of me
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76. When studying for my classes I try to determine which concepts I don't understand well.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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77. I often find that I don't spend very much time on my classes because of other activities.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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78. When I study for class, I set goals for myself in order to direct my activities in each study period.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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79. If I get confused taking notes in class, I make sure I sort it out afterwards.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	---

80. I rarely find time to review my notes or readings before an exam.

<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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81. I try to apply ideas from course readings in other class activities such as lecture and discussion.

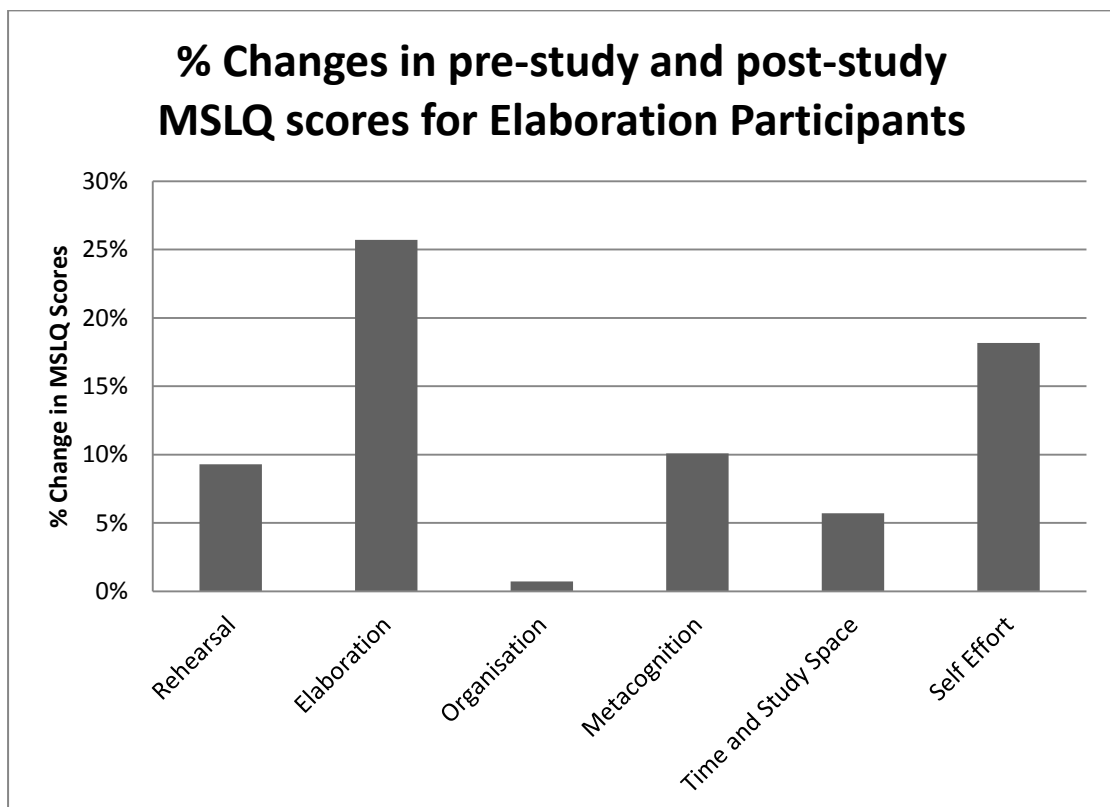
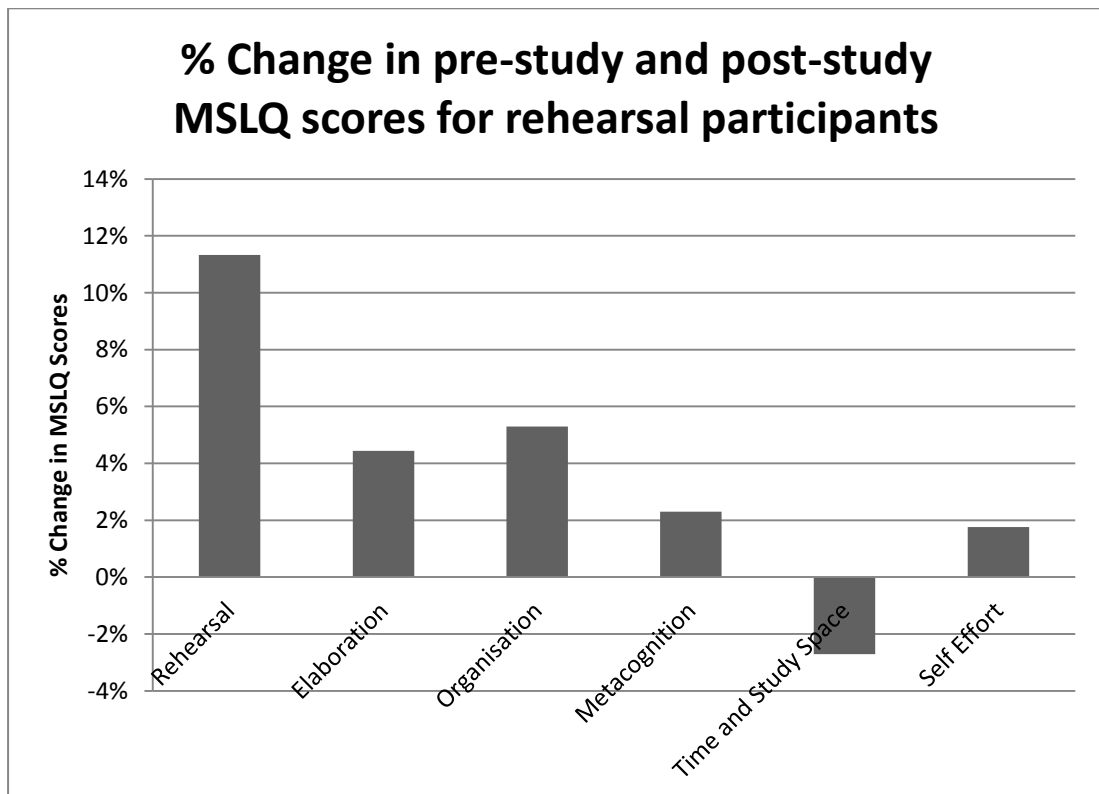
<input type="radio"/> 1. Not at all true of me	<input type="radio"/> 2.	<input type="radio"/> 3.	<input type="radio"/> 4.	<input type="radio"/> 5.	<input type="radio"/> 6.	<input type="radio"/> 7. Very true of me
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10.10 Appendix J: Main Study Text Message Schedule

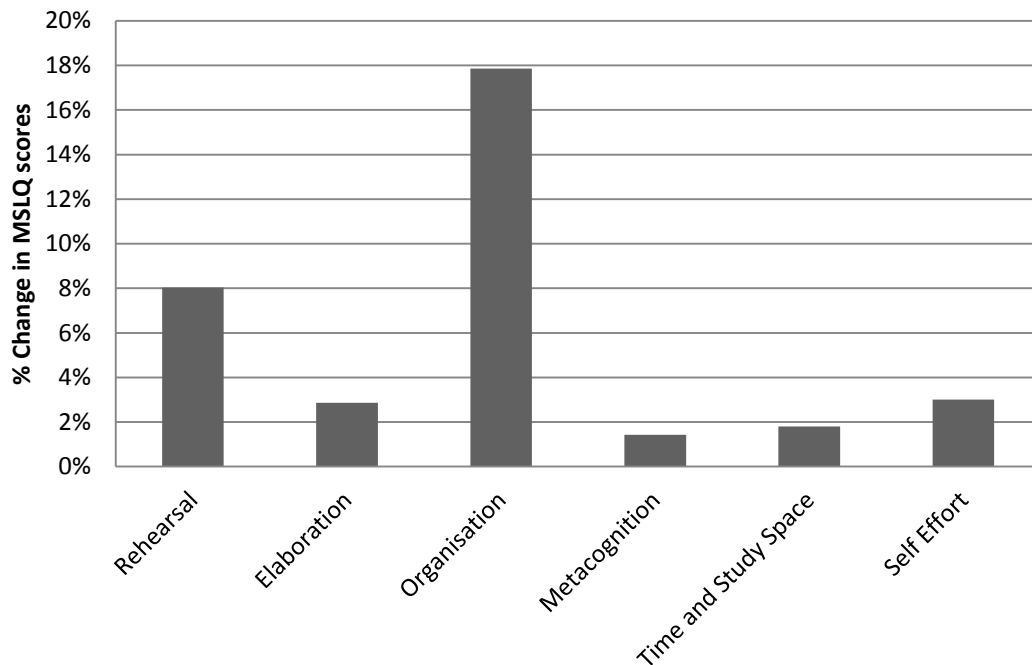
The following table describes each of the learning strategies and the relevant prompts that were sent to the identified students:

Learning strategy	Description	SMS prompts	Day/ time
Rehearsal	<i>This scale is a measure of how often students use study strategies such as re-reading class notes and course readings and memorising lists of key words and concepts.</i>	<ol style="list-style-type: none"> 1. Start creating a glossary of important terms and topics in the course. 2. Define these terms and repeat them out loud. 3. As this list grows bigger, divide it into smaller lists of related items. Make up images, rhymes etc., to help you remember these terms. 4. Test yourself by generating a quiz from these lists. 	Monday, morning Tuesday, evening Thursday, afternoon Thursday, evening
Elaboration	<i>This scale reflects how students attempt to summarise or paraphrase the material read in textbooks and how to relate to the material read.</i>	<ol style="list-style-type: none"> 1. Paraphrase and summarise important information. 2. Use your own words to describe material covered during lecture/readings. 3. Try to figure out how each topic relates to the other. 4. What are the connections between the topics? 	Monday, morning Tuesday, evening Thursday, afternoon Thursday, evening
Organisation	<i>This scale refers to the students' ability to select the main ideas from readings as well as attempt to organise and put together what they have learnt in the course.</i>	<ol style="list-style-type: none"> 1. Outline course materials. 2. Identify where text/readings and lectures overlap. 3. Develop connections between ideas. 4. Make charts/visual aids to help you understand how ideas connect. 	Monday, morning Tuesday, evening Thursday, afternoon Thursday, evening
Meta-cognition	<i>This is a measure of how often students think about what they are reading or studying.</i>	<ol style="list-style-type: none"> 1. Skim the reading materials before you begin to see how it is organised. 2. While reading, ask yourself questions about the paragraph you have just read and scribble key words. 3. Try to determine which concepts you don't understand well. 4. Attempt to find out about these difficult concepts. 	Monday, morning Tuesday, evening Thursday, afternoon Thursday, evening
Time and Study Space	<i>This is a measure of how well students manage time and schedules, and use appropriate places to study</i>	<ol style="list-style-type: none"> 1. Write down your goals for each week. 2. Write down what you have actually accomplished. 3. Analyse your goals and what you have accomplished. 4. Adjust the goals, place of study, times, when and whom you study with. 	Monday, morning Tuesday, evening Thursday, afternoon Thursday, evening
Self-effort	<i>This scale refers to students' willingness to try hard to study, even when the work is difficult.</i>	<ol style="list-style-type: none"> 1. Keep a list of topics that you find procrastinating instead of studying for it. 2. Discuss why you think you tend to postpone studying these topics with another student. 3. Can you identify alternative strategies to ensure that you do study these topics? 4. Apply these alternative strategies for these topics. 	Monday, morning Tuesday, evening Thursday, afternoon Thursday, evening

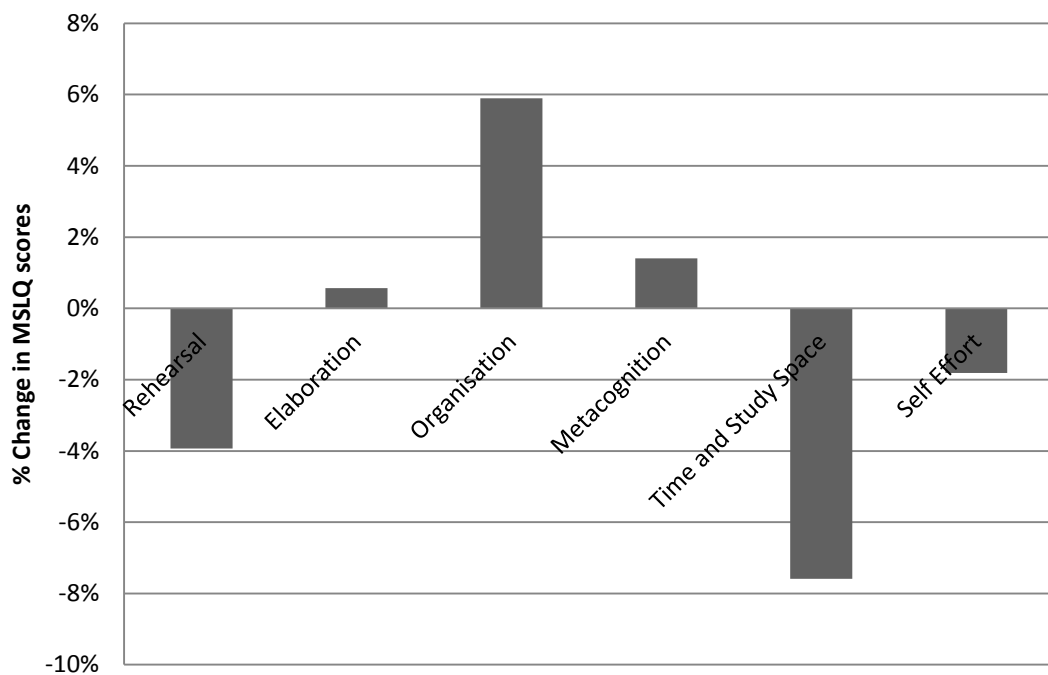
10.11 Appendix K: Individual Skills Development Graphs



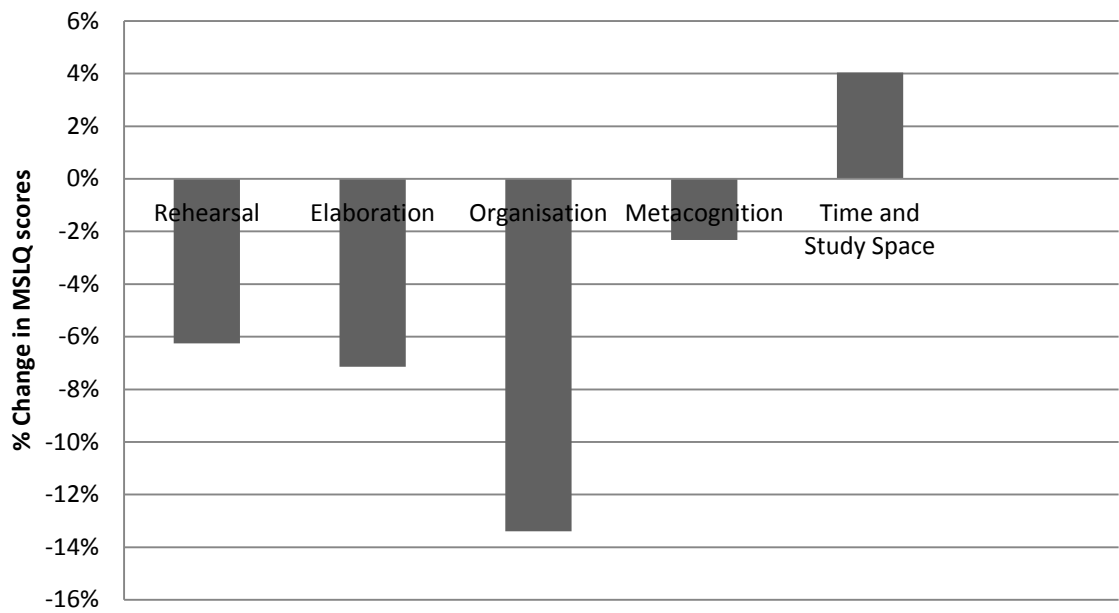
% Change in pre-study and post-study MSLQ score for Organisation participants



% Change in pre-study and post-study MSLQ score for Metacognition participants



% Change in pre-study and post-study MSLQ score for time and study space participants



10.12 Appendix L: Summary of interview transcripts

	1Alicia	2Anne	3Anton	4Cara	5Corine	6Fiona	7Holly	8Kristie	9Megan	10Tamara	11Tatiana	Summary
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Backgr ound	First year student Used to having lots of work due to being from a selectiv e high school Poor at time manag ement Page 1	Studyin g first year primary educati on	Previous experien ce at tertiary educatio n and work. Some teaching experien ce 1	Had some exposu re to higher educati on, complet ed a diploma in childcar e 2	No higher education experien ce at all First year in higher education. Previous studies at high school only	Mature age student who has been out of studying for a while, although has had some experience with higher education study. 3	Completed another Business Management degree before starting this degree, so is familiar with high education studies Had some time between studies, so still has to start with familiarisation of high education study expectations. 4	After high school not sure what to do so studied Diploma in Children services. Had some experience of high ed. Through TAFE studies. “burnt out” after high school... Did better in year 11 than year 12 5	First year at universit y	First year at uni....first year in higher ed. Had a gap year after high school. Did a business admin traineeship 6	Straight from high school	Student s’ come from very diverse backgr ounds. student s straight out of high school. howev er there are also student s who have had a gap year betwee n high school
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Uni study vs high school study	High school and universi ty study experie nces are differen t. There's a lot more indepe ndent work, and the timefra mes are shorter. The work load is	Finds it difficult to organis e time for studyin g. Not used to studyin g especia lly after working for a long time. The universi ty first year course does	May have had difficulty with organis ing and finding time to study and work on universit y relate work. Even though this student is more experien ced with H.E. studies, he still seems to	Her study habits were fairly organis ed, but would get repriorit ised depend ing on her assign ments and homew ork	University study is more independe nt. University campuses can be distracting for first year students as well. At university there tends to be less support from teachers and tutors, more expectatio	At high school this student would study by making notes and reading over information, notes and text books. She would also try to highlight her study notes although wasn't very efficient doing this. 266	She likes to read her notes and text books. She also likes to make notes using colours and images Also tries to reorganise the information given in lectures and texts into her own words and format. Re-writes her notes to try to remember them effectively.	In high school: Wrote down all important points as she went along a course. Colour coded study topics for reference. Great focus on rehearsal	In high school she would write out study notes for the topics. Colour code topics. Create tables Seemed like a very time consumi ng way to organise	Prior to year 11 she was not that regular and good at studying. In year 11 and 12 the school organised study skills training for students and that helped her a lot	would do homewor k, read up on topics and keep log book of what she was studying but unable to do that in uni	Genera lly there is a lot of differ ences in expecta tions betwe n uni and high school study, even betwe n uni and the high ed like tafe and college s. Student
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Study habits	At high school: Write study notes for study Identify key topics Read and re-read the notes Got 'Dad' to quiz on the topics Tend to write	Study habits involve reading and re-reading Read, paraphrase Discuss with someone Reads notes etc, and takes those ideas around when she is	At high school this student didn't have any study method/s Organisation strategy imposed by parents	At high school, this student would read her notes and text books and make notes for herself ...associate these to concepts etc.	Generally, this student would read, and reread, plus paraphrase the subject notes.	Prefers to read and elaborate on the ideas covered in the lectures and the readings rather than anything else.	She likes to read her notes and text books. She also likes to make notes using colours and images Also tries to reorganise the information given in lectures and texts into her own words and format. Re-writes her notes to try to remember them effectively.	In high school: Wrote down all important points as she went along a course. Colour coded study topics for reference. Great focus on rehearsal	In high school she would write out study notes for the topics. Colour code topics. Create tables Seemed like a very time consuming way to organise	Prior to year 11 she was not that regular and good at studying. In year 11 and 12 the school organised study skills training for students and that helped her a lot	At high school she would do homework, read up on topics and keep log book of what she was studying but unable to do that in uni	Most students tend to read their notes while studying. g. Very little evidence to indicate any other study methods were used. Some students even indicated that they
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How do you study at uni	University study approach is similar to the school approach. Although university approach is more focussed on the assessment tasks	Finds it difficult to organise time for studying. Not used to studying especially after working for a long time. Study habits involve reading and re-reading	Organisation strategy worked for this student in high school, although it was imposed by the parents.	At university she has to keep updated with her studies constantly.	It's harder to study and organise notes at university as the subjects are a lot unstructured.	Goes over the readings after class..	Re-writes her notes to try to remember them effectively.	At university a lot of study is assignment based so less focus on rehearsal type study but still tries to include that as much as possible.	The study method used in high school is similar to that used at uni.	Although the study skills workshops were useful, it was not targeted and timed inappropriately. Students were not even prepare with study notes when they were required to summarise them etc	A lot more unstructured, more freedom at uni to do whatever, but also a lot of peer help is available.	Students are using the same study strategies that they used in high school. There was a lot more support available to the students in high school for
Differences	Read,		xxxx		xxxx			Indicates that she has good motivation to study.	xxxx			

Study location	She normally studies at home, studies at night a lot. Normally she likes to study by herself, and mostly at night Comfortable studying at the lounge room,	Communiting At Home, on the couch, watching TV, or spare room Works on campus when she has a lot of work that needs to be done...in the library	Most of the study is done at home. Enjoys the social life at uni.	Studies at home	In high school, there was opportunity for students to contact teachers outside of class time for study help. Would find it easier to ask questions to friends rather than teachers At home	Prefers to study at home, not at university. Uses the time to study when she is commuting on the train. Tries to keep up with her study, but its difficult to find enough time when she is at university. Most of her study involves reading the notes and elaborate on the notes.	Most of her study is done at home as its much easier, and the uni is too distracting to study. Especially with her friends if they are with same class as her.	Most of the study is done on campus as she has a lot of time between classes and facilities like the library is great for studying	At uni she studies on campus. At home she studies in her room, or outside in the sun, lounge room , dining table to keep things interesting.	At uni she has a lot more time to complete her uni work and study. She does most of her study on campus.	Studies at home and uni between classes	The places where student s study varies, although a number of student s indicate that they value the breaks between classes and choose to do most of their
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Inde pendent or collabo rative	Studies alone Page 7	Prefers to study on her own but does like to discuss with friends someti mes	Depende d on parents to draw up a study timetable , and enforce it on him	Studies indepe ndently not so much by choice but as it turns out, for conveni ence.	Independe nt study, most study notes were provided by the school teachers. Little or no collaborati on with other students.	Prefers to study independentlydue to her study style. Finds friends distracting, and prefers to have a different timetable to her friends	Most of her study is done at home as its much easier, and the uni is too distracting to study. Especially with her friends if they are ith same class as her.	Prefers the study style at uni as she is an independen t learner. Appreciates the free time between classes to work on uni work.	To ensure she get work done she has to remove herself from the distracti on by other people like her friends.	Uni can also be distracting with a lot more people to talk to	Uni can be distractin g, But collaborat es with peers on campus	Only 1 student out of 11 that were intervie wed prefers to study with peers. All the other student s prefer to study indepe ndently . Althou gh collabo rative
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Mobile phone uses	Always uses mobile phones Main use SMS, internet , facebook. Mobile phones are essential everything	Gets lots of sms Used to mobile phones	Sms are more effective at supporting study due to the more personal nature of the mobile phones, facebook tends to be too public, and messages can get lost in the chaos, and students may not	Most students are fairly comfortable with sms	Only use for mobile phones is texting	Prefers to receive the messages via sms as most people don't have ready access to emails unlike sms.	Students can put their phones on silent and attend to the calls and/or sms when its convenient for them.	Even when some SMS arrive at inconvenient time it does not bother or disturb her. She generally gets a lot of sms a day...over 20	Mainly SMS	Gets more than 25 messages a day	Uses sms a lot	SMS tends to be the most commonly used mobile phone application. Students are very comfortable with using SMSs. They are able to manage when to
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What types of messages did you receive	The SMS received were about summarising and paraphrasing	Write lists of all the major topics of each of your classes”, and the next one would be, “Write a summary of each of these points	Summarising and paraphrasing and re-wording		This student was prompted to improve their rehearsal study skills.	The sms focussed on rehearsal	This student got the messages that were targeted at improving elaboration skills.	The messages that this student got was to do with metacognition.	The sms sent to her were aimed at improving her rehearsal skills	She received the rehearsal messages.	Rehearsals	
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SMSs easy to understand, and, given the short message due to character limits	The SMS received were very useful. Although may not have followed the instructions right away, went back to the messages when it was more convenient	helpful to get the sms	Sms are more effective at supporting study due to the more personal nature of the mobile phones, facebook tends to be too public, and messages can get lost in the chaos, and students may not	It was good to receive the sms, especially when students were getting ready for tests, exams etc. The sms reminded them to start studying, even though	The sms content was easy to understand and related to Was able to understand the actual sms language that was used	The sms content was extremely relevant, and this student can see the value in using those strategies, but the time sometimes was inconvenient, has kept the sms so that she can refer to it later.	Found the continuity in the messages useful. It was useful to know what to do next, as she sometimes may not necessarily know the next steps	She would read all SMSs received Reflect on her study approach Apply suggestions when she was studying	Was unable to follow the suggestions in the sms right away as busy with other things She thinks that she will use it when she starts to study for her exams	She understood all the messages and was able to engage with them but was unable to follow all of them right away	Sms were useful but she would have preferred if the messages were more wide ranging, like if it addressed all the other study skills	All the students reported that they did not have any problems understanding the content /instructions of the SMSs
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Read afterwa rds?	Yes	Saved copies of it, liked the progres sion of the messag es, support	Even though the students didn't read or attend to the message s immediat ely, they were useful as a reminder about studying, as well as knowing that the message s were related to study, so	In cases when student did follow the instructi ons from the sms explicitl y they did come togethe r. Took mental note and made time to get back to it later	Would have preferred to get email messages with the whole intructions all together	Student take mental note of the messages content.	She read all the messages, even if she did not act on them straight away. Most of the messages that were received on the weekends got more attention as she was ready to study on the weekends, and was in that frame of mind.	She did not follow any of the messages straight away as she received the messages when she was doing something else.	She would read the sms and make a mental note of it to work on later on She has saved the sms on her phone for referenc e. She took a mental note of the message	The messages got accidently deletes and was not happy	She did go back to some of the messages to refer to the study approache s suggested .	Only one student indicat ed that she would have preferr ed to get an email with the whole study skills instruct ions, rather than snippets of it via SMS. Most
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SMS helped with study?	The SMS are helpful Can refer back to the messages when convenient. The messages reminded about studying and I can remember	SMS provided more support - appreciated Support provided freely without having to look for it "I'm a bit more brave now to ask questions as well." Page	It was important to have the messages with particular, unique, customized content, as opposed to say just a simple reminder sms about study. Students can if they like set an alarm, or	Once the student read the messages, she was able to grasp the general idea, and then was able to use these during study sessions.	The breaking down of the messages into small sms. Students were able to see that each sms was building on from the previous one	She has read all the messages and made mental note of the content, can see it being useful when she is actually preparing for her exam and studies. Has saved all the messages and will be referring to it.	Student saved all the messages and plans to go back to the messages later when she is ready to study.	Would read the messages and although may not act on it right away would think about what to do and how to include the suggestions in her study. There the messages invoked cognition about appropriate study methods. She thought that the	The sms were useful and can see it being useful.	She could not follow the instructions right away as it was received when she was busy etc But when she was ready to study she did follow it	Generally found the concept useful. The sms would prompt her to start thinking about studying	All the students found that the SMS were helpful for their studies. Even when some students were unable to follow the instructions right away they were
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Did you apply only for EDIC101 or other subjects	The SMS were used and relevant across all the first year subject at university. It was not seen as just for one subject	Overall in all subjects	overall	Not just for this subject	The messages can be applied across to other subjects as well as this one.	Can see that the message content will be useful for other subject areas as well.	Although the students were recruited within edic101, students did not feel that they had to apply the learning strategies only for that subject.	The messages were applicable across the course, all different subjects	She has already started to apply the suggestions to other subject instead of EDIC101	Used the study strategies for other subjects not just edic101	Across all subjects	Even though the messages were incorporated with EDIC101, All the students applied the strategies in all the subjects they were studying. They found
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Any messages outside of scheduled time....technology reliability	Although all the SMS were scheduled to arrive between 7.00am and 10.30pm some were delivered outside of these times.	All messages were received during intended times	Can see the benefit in using this technology to support learning in this way. Can also see the benefit for this in other, more challenging subjects.	Most convenient time to receive sms is when student is actually away from university	Student got used to getting SMS from me so was not disturbed by them, but would have preferred getting the messages on weekday afternoons as that was the most convenient time when she would study.	Did not find the sms disruptive at all, most students are used to getting lots of sms.	Did not find the sms intrusive to her private life.	She did not find the sms annoying at all	All the messages were received during acceptable times as intended	The messages are not interrupting when she arrive, she is used to it	Generally found the concept useful. The sms would prompt her to start thinking about studying	All, except 1 student, indicated that the messages were received between 7.00am and 10.30pm. They way in which the SMS messaging
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SMS annoying at inconvenient times?	Even though one SMS was received when the participant was sleeping, it was not considered annoying	Did not find the sms annoying. Wanted to send me a thanks message.	Even the SMS that was received when student was in bed was not disruptive.	Student puts phone on silent when occupied with work. Choose when to look at the messages, and the sms will not get lost amongst everything else	Student dismissed the messages that were received during their social events.	With the sms, she can see who is sending the messages , and so can choose to attend to them or wait till later..	Did not find the sms intrusive to her private life.	She did not find the sms annoying at all	Although when she is busy she will not open the messages right away but will get back to it the messages later when it was more convenient.....and then take a mental note of it	The sms were not annoying or distracting	The messages were well timed and not disturbing for her	All the students indicated that they did not find the SMSs annoying. 1 student reported that she received the SMS when she was sleeping but even then did not
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SMS during work/leisure activities?	The SMSs were not disruptive. She was able to look at it and attend to it when it was more convenient.	no	Even the SMS that was received when student was in bed was not disruptive.	So student would prefer to be contacted in their informal times/spaces Does not think that the sms was disruptive to private lives. In fact they would	The student thinks that SMS is a useful tool to use to support students learning, although similar objectives could possibly have been achieved using email as well	Used to getting lots of SMS	Students can choose to attend to the sms if they want, not matter where they are. So even when students are discussing unrelated stuff they may not necessarily look at the sms	She did not find the sms annoying at all	Sms in the evening would be more useful	Not disrupting	Even when the message was distracting she had a quick read and then dismissed it	They did not find the SMS disruptive. They can choose if they want to attend to the messages or not, given their circumstances. One student indicated that
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Should these SMS support be included for all uni student s?	The SMSs do have the potential to affect the way in which university student s study. Could be incorporated into first year university subject s.	In primary schools student s would not have mobiles anyway	Can see the benefit in using this technology to support learning in this way. Can also see the benefit for this in other, more challenging subjects.	The sms were helpful, and acted as a reminder to study, but it also contained how to study which was even more helpful.	The student thinks that SMS is a useful tool to use to support students learning, although similar objectives could possibly have been achieved using email as well	Prefers to receive the messages via sms as most people don't have ready access to emails unlike sms. The sms mail is also mostly ignored by the students, sms is something that you cannot ignore, and can refer back to it when needed. Not only were the sms effective in reinforcing the study skills concepts,	Would benefit from this support provided over a number of sessions.	She thought that the messages were useful and could relate to it. Understood the messages.	She can see it being used to help even high school students during their study periods	Although she had help with study skills in high school, the sms were a lot more targeted The high school workshop was a generic one for 500 students.	She has saved all the sms and is planning to go back and look at them at a later time	All the student s can see this sort of support included for all uni student s. They feel that all student s can benefit from these strategies, particularly since the
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Facebook?	Checks facebook all the time, between classes, breaks etc	Checks facebook most of the time	Social networking is the norm for most of the first year university students, they are using it very frequently.	Uses social media all the time	Uses social media	Very frequent user of facebook	Uses facebook but not a big fan	Is not a heavy user of facebook but does check it occasionally. Mainly because all her friends are available face to face	Light user if facebook	Uses facebook		All student s use facebook. Only one student indicated that she was not a heavy user of facebook.
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Facebook vs SMS	There is a difference in using SMS and facebook for supporting learning. Facebook is considered more open, not private social networking.	Sms is preferred. Facebook is more personal	Sms are more effective at supporting study due to the more personal nature of the mobile phones, facebook tends to be too public, and messages can get lost in the chaos, and students may not	SMS is more useful	Student would not be comfortable with using mobile as a university wide policy, but would prefer to use her email instead, how about if universities give out mobile phones to students? ????????	Still prefers using sms over facebook as sms is more instant, and students just have to get it immediately, they can choose to ignore it but they do get the message straight away	Use of facebook for similar purpose would not have been so effective. Thinks that the sms evokes more responses, and generates interest.	Would have been comfortable to have this study (help) provided through facebook through their private messaging application	Would prefer sms	She is more willing to use sms with her students in the future but has concerns about using facebook as facebook is more private		All students would prefer to use SMS over Facebook for study support. One student indicated that she would be comfortable with facebook
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Overall, what did you think about the SMS support	I think they were helpful, like the ideas within the messages were helpful. It was just putting them into practice which was the hard bit but it kind of gives you the ideas of what to	Yeah, I did think it was useful and I was virtually thinking, “Oh I wonder who’s going to do all this”, because it would be really useful for first year you know, to	Good, I never thought, I never thought of it like that idea existing, like someone sending message s to help you study, it’s kind of two different worlds sort of, like someone that hinders you to	Ah yes, because it’s like everyone texts, it’s more than a phone call because some people get really nervous talking to people on the phone so with the text	I think it’s definitely interesting and it could be helpful, I think that there are possibly better ways to do it, for me anyway I think that email would be a more effective way to do that sort of thing but to still keep it very short and possibly to	I think it’s good because I think it’s easily accessible, like people don’t necessarily always check their emails or if you put it up on, I don’t know or something, people just go, “Oh ...”, you know, “Ignore ...”, or whatever whereas if you get it on your mobile it’s kind of, oh no I find it – everything’s on my phone like reminders and things like that, so I find it helpful to have	Yeah, I generally think it’s an awesome concept to be able to see the study skills that you work on and to be able to have tools and information and how it ... 17;20 ..., I think that, like I’ve been studying for a while and it’s generally and even at high school and junior school it’s something that you’re always struggling with, how to study better and no one can kind of help you or give	I found them useful information, but at the same time I found it difficult to apply, just because like I hadn’t really started studying at that point. So probably now,	Yes. They were small steps, which was good. Like, you know, easy to digest kind of thing, and they were – yes, like I say, I lost track and it’d be good if you can just say something like – ‘you know, I’ve got assignment s at the moment – this is good, but just hold off for like	It was. I had no... I didn’t even think of doing a glossary so I was like “oh, that’s a really good idea” when I got the message .	Overall, I, very useful, acted like a reminder to get students to continue working on uni work. Anne-use of mobile s for this was “ingenious” as
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